the OIL AND GAS JOURNAL
PUBLISHED WEEKLY OCTOBER 3, 1960

Jet-Fuel Demand -GOING UP

THE 1961 DOMESTIC OUTLOOK

Commercial—Up 50% to 140,000 bbl. daily
Military —Up slightly
Over-all —Up about 16%

▸ 49

FPC shapes new policy in its Phillips decision

Long awaited—and significant—ruling

- Tells how producer cases will be handled now
- Outlines specific price guides for producing areas
- Explains why FPC is abandoning rate-base procedure
- Describes FPC's general approach to costs

▸ 56

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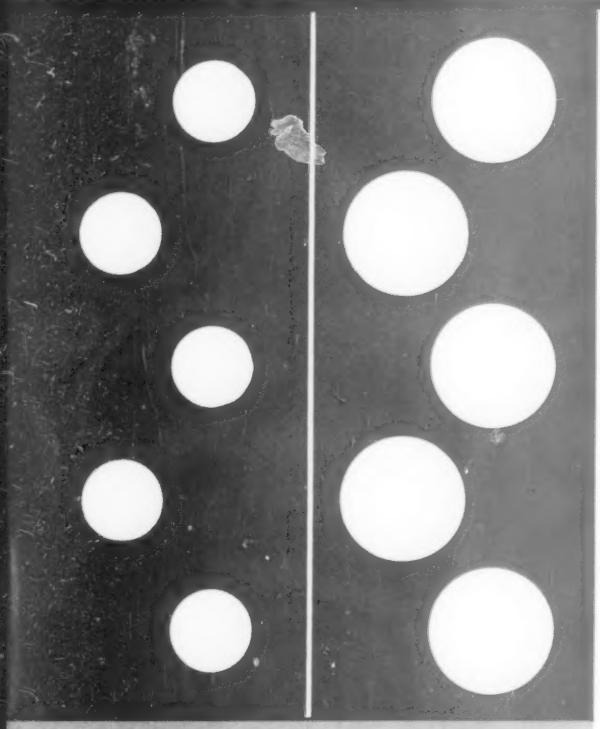
Another FIRST by LANE-WELLS

BIG HOLE PERFORATING

For Formation Treating

56% LARGER Diameter • 144% LARGER Opening

780 SUPER E BULLET



Comparison of area of standard perforations (above, left) and 780 Super E perforations (above, right).

You are looking at the actual size of perforations produced by Lane-Wells new 780 SUPER E BULLET Perforating. Compare these holes with the size of perforations produced by standard bullets—compare the hole size with even smaller holes by other types of perforating.

Designed especially to produce a large hole and maximum formation cracking, the 780 SUPER E BULLET really paves the way for hydraulic fracturing, explosive fracturing, acidizing, and other types of formation treatments. Because the 780 SUPER E BULLET is fired by a standard Lane-Wells Type E gun, you get all the advantages of selective firing and proved performance.

Ask your nearest Lane-Wells representative about this newest service by the company that originated perforating for the petroleum industry!

You're AHEAD with Lane-Wells' Superior Service

LANE-WELLS CO.

HOUSTON, TEXAS

LOGGING · PERFORATING · PACKERS · BRIDGING PLUGS

DRESSER INDUSTRIES, INC.

OIL · GAS · CHEMICAL · ELECTRONIC · INDUSTRIAL

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OIL AND GAS JOURNAL
Vol. 58, No. 40

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TECHNOLOGY—OPERATION

Drilling-Production

New Graphical Method for Analyzing Velocity Logs 79

By C. R. Davis

This method has found one field and improved numerous completions in troublesome fields. Examples show how graphical techniques can be used to (1) provide negative data, (2) locate oil in the absence of other positive data, and (3) confirm discovery of oil suggested by other data.

Hydraulic Wall-Anchored Drill Collar Promises Lower Drilling Costs 87

By J. M. Kellner and A. P. Roberts

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Momentum-Change Mass Flowmeter is Practical and Accurate 90

By G. L. Farrar

Test installations by nine oil and gas companies verify the dependability of the meter under a variety of field conditions in the measurement of gas. Simplicity of method and of meter make this technique attractive.

Oil-Well Pumping—17 110

By Joseph Zaba

Sucker-rod failures (continued).

Pipelining

Set-Point Control Governs Colorado Interstate System 112

This technique is being used in the first stage of an automatic control system. The method provides for the control of a single condition, discharge pressure in this instance.

Solving Gas-Hydrate Problems 116

By L. E. Connealy

Injections of methanol are used by Texas Eastern Transmission Corp. to prevent the formation of gas hydrates. Methods have been refined so that both the frequency of occurrence and the cost of correction have been reduced appreciably.

Refining-Processing

British American Installs First HF Unit 86

Refinery Cost Indexes 94

Shortcut to Pressure-Drop Calculations 99

By J. O. Ball

Here is a short, simple method which has been proved accurate for all cases which have been checked. It can be used to determine the pressure drop for turbulent flow of varying density fluids—liquids, gases, and mixtures of the two—in short lengths of process piping such as condensing coils and furnace tubing.

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Discoloration from asphalt—drilling clays or earths.

New Charts Predict Vapor-Forming Qualities of Motor Fuels 108

By Oscar C. Bridgeman and Elizabeth W. Aldrich

Two simple charts have been developed for evaluation of these characteristics from a knowledge of Reid vapor pressure and 10% point slope.

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Refinery chemistry—Part 4.

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Oct. 3, 1960

FPC is taking new approach for natural-gas pricing:

As upshot of Phillips decision (p. 56)*, FPC will abandon traditional rate-base method. Instead it will seek to establish fair prices for the gas itself and not for each individual producer.

Area pricing will be the starting point with two guides for each area: One price for new sales and another for existing contracts.

Higher rates either in new contracts or in escalations in existing contracts will have to be justified in a rate proceeding. Cost will be only a part of guiding factor.

Don't expect a big change in crude import program even if Interior goes through with revisions it is considering.

Agency is studying factors involved in domestic supply and demand forecast for products. If some factors are eliminated or adjusted, over-all total of crude allowables would be affected.

Likelihood is that the end result will be lower crude quotas—but reduction probably would be small.

▼ ▼ ▼

Wildcat completions are now trailing last year's totals as the fourth quarter starts. This reverses the upward trend in wildcatting that has brightened the exploration outlook. Until late August, wildcats were ahead of 1959 totals.

Latest figures: 6,961 wildcat completions compared to 7,194 at this time last year. Of these, 613 found oil, 78 condensate, 235 gas, and 6,035 were dry. Last year there were 668 oil strikes, 90 condensate, 229 gas, 6,207 dry.

Famed Abo reef trend in southeastern New Mexico edges closer to Texas. Texaco 1 R. J. Byers in Lea County 5 miles northeast of Knowles townsite is testing Abo oil. Location is only 1 mile northwest of Clearfork production in Tex-Pac field in Gaines County, Texas, and 3 miles east of Garrett field in New Mexico.

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*Refers to article in this issue giving more details. Where no page is given, the item is a Newsletter exclusive.

A new Alaskan gasser with potential of more than 80 million cubic feet daily has been discovered on the Kenai Peninsula by Halbouty Alaska Oil Co. at about 5,000 ft. Three other sands also are considered commercial but await development of a market before testing is done (p. 70).

First major oil discovery in Wyoming's Wind River basin since opening of Grieve unit 5 years ago is reported in Natrona County by National Cooperative Refinery Association.

The 1 Wallace Creek unit flowed at rate of 59 bbl. per hour on test of Muddy zone at 10,333-374 ft.

Underwater completions in the open sea are getting first real tests in a shallow oil pool off the northern coast of Peru which defied normal drilling and production techniques (p. 65).

Jet-fuel demand can expect another big boost next year thanks to continued expansion of the world's jet fleet. A substantial gain will occur in the U. S. because domestic airlines are taking more than half of the new jets.

The outlook: Demand is expected to average 381,000 bbl. daily this year, a gain of 55,0000 bbl. Over-all domestic demand should increase 16% next year to 434,000 bbl. daily (p. 49).

Watch thermal diffusion as a prospective new technique for making high-viscosity lube specialties.

Standard of Ohio reported last week at AICHE meeting in Tulsa that costs have been reduced 40%. Oils with viscosity index up to 150 without additives have been produced in the lab.

Sohio says a 10-unit plant yielding 1,200 to 3,300 gallons per day would cost $110,000.

▼ ▼ ▼

The 1961 model autos out so far are hard on grease.

Cadillac has rubber isolators at chassis points to eliminate need for lubrication. It also offers a crankcase ventilation kit as antismog device for cars sold in the Los Angeles area.

Ford, Mercury, and Lincoln will require no chassis grease job up to 30,000 miles. Fittings are prelubricated at the factory with a new compound containing molybdenum-disulfide. Lincoln also advises a 6,000-mile oil change.

Outlook for growth in gasoline sales appears bright despite expected increase in compact cars, says Amoco's Marketing Vice President C. H. Coughlin.

His prediction: 16 million compact cars on the road

by 1965 and sales of 1.75 billion barrels of gasoline in that year.

If these sales materialize, they would represent a 14% growth over 1960 and would be only 3% below volume estimated if there were no compacts.

▼ ▼ ▼

Pipeliners soon may start gluing joints instead of welding them.

Tests have shown up favorably in the field on small-line gas, oil, and salt-water service where a tough epoxy glue and a simple crimping tool joined the belled-end joints of strong, thin-wall line pipe (p. 52).

A 1,355-mile LPG pipeline system of 4 to 12-in. diameter will be built from the Houston area to Danville, Va., by Transcontinental Gas Pipe Line Corp.

Line will have initial capacity of 60,000 bbl. daily of propane and butane for southeastern U. S. markets. The project also includes two underground storage caverns and will use Transco's present right-of way in the area (p. 66).

▼ ▼ ▼

Mexico and Argentina have agreed to a mutual help plan whereby each country will invest in developing the other's oil industry. It's the first step in a sweeping Latin American oil development project that also will involve Bolivia, Brazil, Peru, and Venezuela (p. 73).

Industry notes: Texaco and Jersey Standard have been rated among the country's 20 best-managed firms in Dun's Review poll...Indiana Standard's Swearingen believes oil must slow its expansion programs until supply and demand achieve a balance or it must expand in new directions...Swing of a few majors toward nationwide marketing is forcing others to promote exchange privileges of their credit cards...Some oil companies are financing their drilling programs up to 80% by bank loans at 6% interest. They conserve cash for other projects. Critics fear this may be playing into hands of foes of depletion allowance who might contend income from the allowance should be used for new drilling...Plymouth Oil will move its operating headquarters from Pittsburgh to Houston in February and may move executive offices there too.

Advice from a Washington politician:

Talk to your congressman while he is at home, even if he may not be facing any real opposition to reelection. It is your best opportunity to let him know your views on oil and other issues. If there is a battle for a congressional seat, talk to both candidates.

Market Memo

Oct. 3, 1960

Crude market continues extremely tight, and this is reflected in scattered crude-price increases.

Derby Refining raised by 7 cents a barrel its price for 16,000 bbl. daily of crude in Southwest Kansas and Oklahoma Panhandle. Top price is $2.77 per barrel for 40-45°-gravity oil.

California heavy crude has been boosted as much as 10 cents a barrel for 14°-gravity ranging down to 1 cent more for the 22-24°-gravity. California Standard started the price upward and was joined by Union and Mobil. At the same time California Standard increased fuel-oil prices 10 cents.

Market for petroleum products, meanwhile, is on a delicate balance—neither bullish nor bearish.

Refiners are loaded with products and are awaiting spot demand to give the market a price trend. Inter-refinery purchases have not developed. They were expected to result from the tight crude market but have been discouraged by the strength of posted product prices.

In the Gulf Coast, spot sales are few and far between. No discounts are being offered on gasoline or middle distillates. Quotations on gasoline are being held to Gulf Coast low posting of 11.25 cents for 92-RON.

Kerosine is firm on the coast at 9 cents and No. 2 is being held for its posted price of 8.25 cents.

In the Mid-Continent area, gasoline demand and prices are holding firm. While some spot discounts continue, they have not been prevalent. The posted price for 91-RON gasoline remains little changed at 12.50 cents.

A few inter-refinery inquiries for middle distillates are reported with few sales. Posted prices continue firm at 10 cents for No. 1 and 9 cents for No. 2.

Chicago gasoline market is quiet but firm at its posted level of 12.625 cents for 92-RON. Discounts of one-quarter cent per gallon on middle distillates in Chicago have caused some nervousness. However, posted prices are holding at 10.25 cents for No. 1 and 9.50 cents for No. 2.

River markets are unstable, lacking spot buyer interest. Asking price of 8.50 cents for No. 2 at mid-river terminals is not attractive to up-river buyers. Gasoline at low Gulf Coast of 11.25 cents for 92-RON also brings out no buyers.

Good Wells Make Good News

Recent Profit-Building Treatments with Fracturing and Abrasijet

October 3, 1960

The use of Abrasijet* — Dowell's abrasive jetting service — before fracturing often improves results of the treatment. Sometimes, it may even eliminate the need for fracturing. Here are four recent treatments in which Abrasijet helped operators improve profits.

- **Jack County, North Texas** (Three Old Oil Wells) These wells had been completed open hole in an 11-foot section of the Buttram sand at about 2600 feet. Previous fracture treatments had broken into water. Dowell engineers cut circular notches in the oil pay with Abrasijet to induce horizontal fractures. Each well was then fractured using 1000 gallons refined oil and 1000 pounds 20-40 mesh sand. Production from the three wells was increased 90 bopd with no water.

- **Kern County, California** (New Oil Well) This well was completed in the Vedder sand between 11,884 and 11,980 feet. Standard method of completion in this field had been to run a drill stem test, then sidetrack and recomplete with oil-base mud at a cost of $50,000 to $65,000. Dowell recommended Abrasijet and Waterfrac instead of sidetracking. Four circular notches were cut using Abrasijet. Waterfrac, using 30,000 pounds gelled water and 3500 pounds 8-12 mesh walnut shells (instead of sand), followed each notching. Production after treatment was 300 bopd instead of 100 bopd normally expected after conventional completion. Cost saving was over $10,000.

- **Eddy County, New Mexico** (New Oil Well) This well was to be completed into the very tight Premier sand. Operator needed a completion that would initiate a fracture and lower the breakdown pressure. Dowell used Abrasijet to cut slots at four levels between 3200 and 3225 feet. Lease oil, carrying one pound sand per gallon, was used to jet each level for thirty minutes. Well was then fractured using 12,000 gallons refined oil and 45,000 pounds sand. Treatment was down 3" EUE tubing, 10 bpm at 5000 psi. Well tested 364 bopd after treatment.

- **Burke County, North Dakota** (New Oil Well) This slim-hole completion was into the Madison lime at about 6100 feet. Operator wanted to use Abrasijet to cut a single notch to induce horizontal fracturing and avoid breaking into water. He did not want to cut the string completely, however, because a bottom-hole pump was scheduled. A single 180-degree notch was cut. After swab testing, the well came in flowing without further treatment. Most other wells in the area required fracturing and pumping.

The chances are good that your Dowell engineer can tailor treatments for your wells to improve production and reduce costs. Dowell services and products are offered from more than 150 offices and stations in the United States, Canada, Venezuela, Argentina, and Germany. Dowell, Tulsa 1, Oklahoma.

*DOWELL SERVICE MARK

Services for the oil industry DOWELL
DIVISION OF THE DOW CHEMICAL COMPANY

They work without pampering!

14 "Oilwell" booster units prove good investment for East Texas operator

The Model OWL Compressor above is one of 14 "Oilwell" booster units owned by Dorfman Production of Dallas, and currently in operation in East Texas. One of the most recent deliveries, a 5 x 9 unit, will discharge into a 450 psig sales line with an inlet pressure initially at around 400 psig, with ultimate depletion down to 75 psig. Estimated daily volume ranges from 1,900,000 down to 300,000.

Dorfman's superintendent, A. J. Donovan, who operates these 14 "Oilwell" booster units, expresses complete satisfaction with their low operating costs, efficient performance, and low maintenance. These "Oilwell" compressors work around the clock, day in and day out, with minimum attention.

"Oilwell" Gas Compressors range from 25 to 500 hp and can be furnished for single or multi-stage compression to perform a wide variety of gas-handling jobs. Compressors, engine, and necessary coolers, gas scrubbers, mist extractor units and controls are mounted on a structural steel skid, ready for installation.

For detailed technical information about the advantages of an "Oilwell" Compressor on your next gas-handling problem, visit your "Oilwell" store or write to Compressor Department, Oil Well Supply, Dallas 21, Texas.

USS and "Oilwell" are registered trademarks

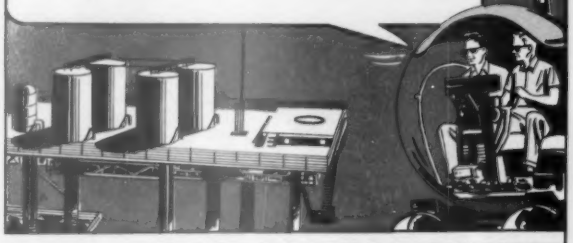
USS Oil Well Supply Division of United States Steel

Executive Offices: Dallas, Texas
Export Offices: 30 Rockefeller Plaza, New York 20, N. Y.

1.

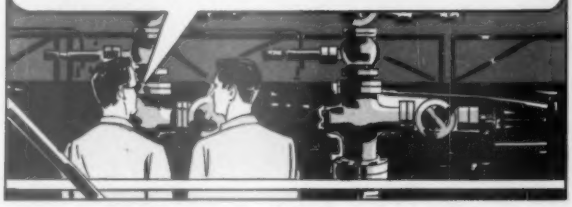
OTIS SURFACE SAFETY VALVES

—equipped with automatic pilots—shut in the six wells on this platform and PREVENTED A MAJOR FIRE that could have cost us several million dollars.



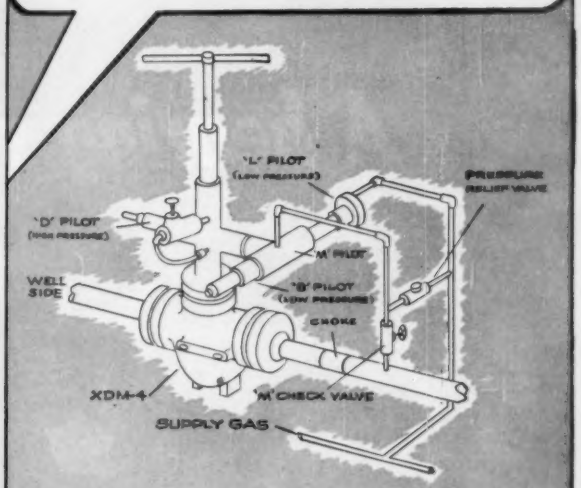
3.

The six wells were producing 32 M.M.C.F.D. when an equipment failure boosted the temperature in one of the heaters to about 1,000° F. This set the platform on fire. But we didn't lose our wells or the platform—thanks to the Otis Safety Valves. When our pumper got out here he found all of the wells shut in, and only a small fire burning, which he extinguished. After making minor repairs, the safety valves and pilots were reset and the wells put back on production.



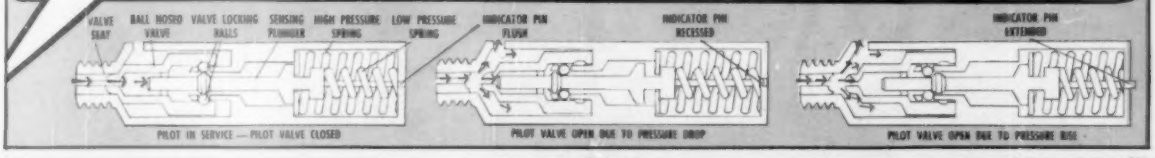
2.

Here's a diagram of the safety valve and automatic pilot installation we had on this platform. Each of the six wells had a Type XDM-4 Otis Surface Safety Valve installed between the wing valve and the choke. The safety valves and pilots were installed so as to (1) shut in an individual well should a freezing condition exist in a flow line or choke; (2) shut in all wells on the platform should a flow line break, or (3) shut in all wells on the platform should the gas sales line break, or should something happen to any of the auxiliary equipment on the platform. In this case it was high temperature on a heater that activated a Type L Otis Pilot to shut in all the wells.



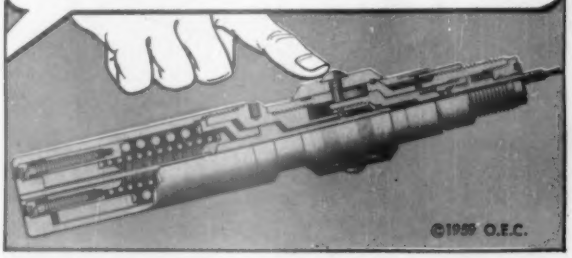
4.

Speaking of resetting pilots, have you seen the new Type E Otis Hi-Lo Pilot? It's so simple to set and reset a boy could do it. These schematic diagrams show the pilot in its three operating positions: set and ready to operate; opened as a result of a pressure drop; opened as a result of a pressure rise. The new Type E pilot has many features we like. To list a few—it's quiet. There's no loud pop when it opens. The standard model is rated to 8,000 P.S.I. and we can get higher pressure ratings on special order. The Type E is adaptable to remote control or external control systems using electricity, hydraulic pressure, or microwave. You can trip the pilot manually without any special tools. We've found the pilot accurate to plus or minus 1%. It has a visual indicator to tell you when the pilot is locked out of service, and another indicator to tell you whether the pilot operated due to a pressure rise or drop.



5.

To get back to resetting the Type E Otis Hi-Lo Pilot—here's all you do. After the pilot has operated you twist this reset collar to the right. This closes the pilot and exposes a red band, which is a visual indication that the pilot is locked out of service. When the indicator pin is flush with the end of the pilot you can put the well back on production by twisting the reset collar to the left. We'll be using a lot of these pilots in the future because of their simplicity and many advantages.



6.

The Otis Surface Safety Valves and Pilots we installed on our platform only cost $6,500. That's a pretty small investment to protect a several-million-dollar installation. And this isn't the first time Otis safety equipment has saved us a substantial loss. Experience has taught us we can rely on Otis safety equipment. If you have ANY UNPROTECTED WELLS—especially in isolated locations or in critical areas—I suggest you call your nearest Otis office now. Let an Otis safety valve expert help you work up the proper safety program for your wells—TODAY—BEFORE YOU NEED IT.

Otis—"Everything's Under Control"

OTIS

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General Offices: 6612 Denton Drive • Dallas

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NEW

A bearing seal so good

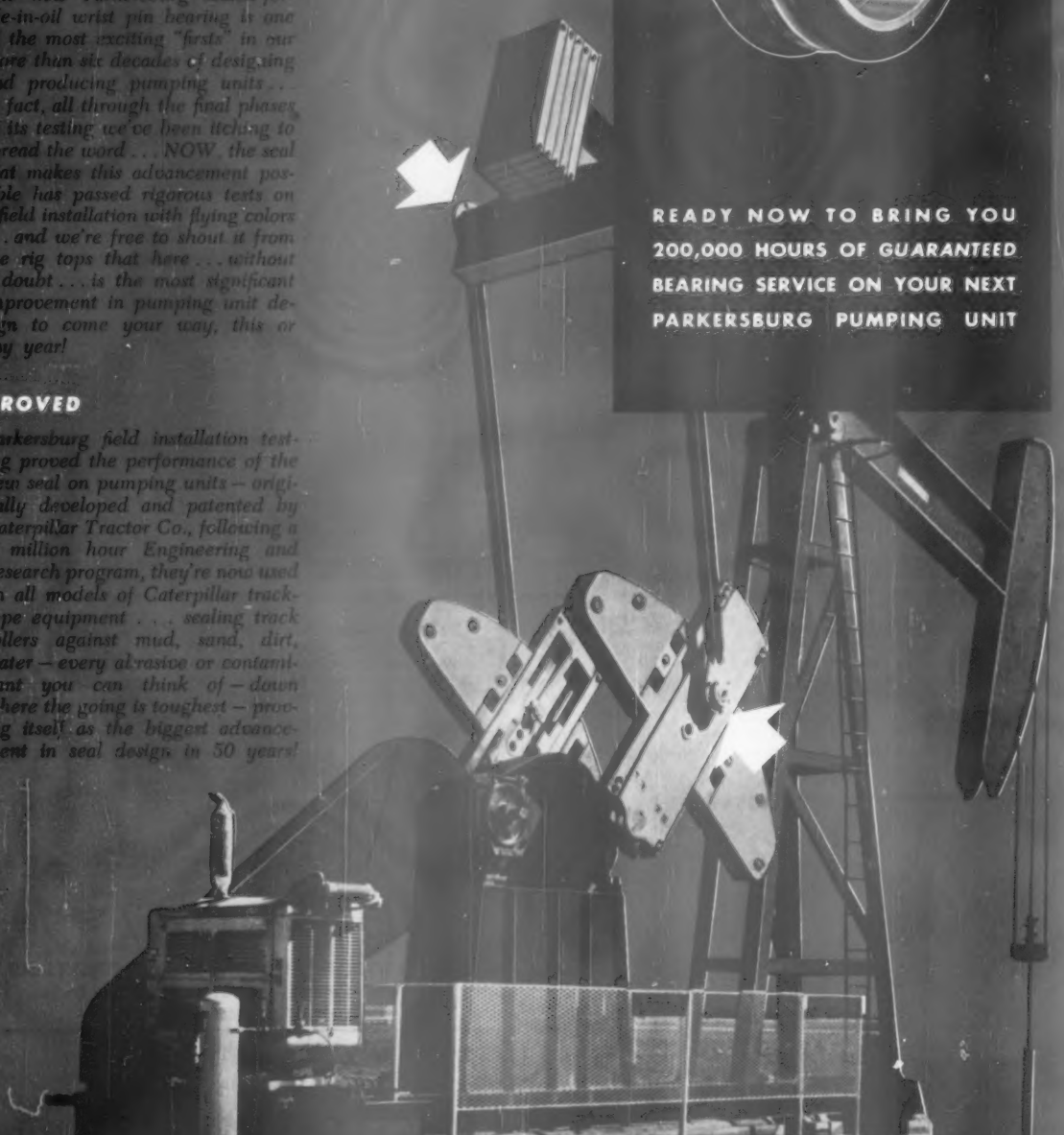
TESTED

The new Parkersburg sealed-for-life-in-oil wrist pin bearing is one of the most exciting "firsts" in our more than six decades of designing and producing pumping units . . . in fact, all through the final phases of its testing we've been itching to spread the word . . . NOW, the seal that makes this advancement possible has passed rigorous tests on a field installation with flying colors . . . and we're free to shout it from the rig tops that here . . . without a doubt . . . is the most significant improvement in pumping unit design to come your way, this or any year!

PROVED

Parkersburg field installation testing proved the performance of the new seal on pumping units — originally developed and patented by Caterpillar Tractor Co., following a 2 million hour Engineering and Research program, they're now used on all models of Caterpillar track-type equipment . . . sealing track rollers against mud, sand, dirt, water — every abrasive or contaminant you can think of — down where the going is toughest — proving itself as the biggest advancement in seal design in 50 years!

READY NOW TO BRING YOU 200,000 HOURS OF *GUARANTEED* BEARING SERVICE ON YOUR NEXT PARKERSBURG PUMPING UNIT



NEW

it's GUARANTEED to retain oil for 200,000 HOURS

NEW *major advance in pumping unit design from* **PARKERSBURG**

The new 200,000-hr. seal locks out all abrasives, all contaminants . . . positively retains not grease, but oil . . . the lubricant recommended as first choice by all bearing manufacturers because it dissipates heat faster, lets bearings run cooler . . . assures longer life for bearings and lubricant. Two hardened ferrous metal sealing rings maintain oiltight, self-adjusting-for-wear contact under constant pressure from two specially compounded oil-heat-and-cold-resistant rubber "O" rings. The new seal can be reused and removed or installed without any special tools of any kind. And it carries Parkersburg's guarantee for 200,000 hours of operating service.

So here is what you get with Parkersburg: You buy a pumping unit . . . the bearings are filled with oil . . . the unit is ready to run . . . you stop climbing around it every month or so with your grease gun, worrying whether you caught everything . . . you save money on grease because the lubricant you get with the unit lasts for the life of the bearing . . . you save money on repairs because you have no failures due to lack of maintenance. Exactly what you've always wanted!

THE PARKERSBURG
RIG & REEL COMPANY
Division of Parkersburg-Aetna Corp.
COFFEYVILLE • PARKERSBURG • HOUSTON

engine power
BY CATERPILLAR

Repowering saves 23½% on fuel —increases production

In northwest Oklahoma, near Putnam, Calvert Drilling, Inc., plans to explore to about 12,000 feet. Drilling of the 8¾-inch hole was stopped at 9000 feet to repower rig No. 28 with three Cat G397 Natural Gas Engines. Reports Tool Pusher J. W. Nittler after change-over, "We have been averaging 200 feet of hole per day since installing the Cat Engines, which is outstanding considering present depth and formation. Besides getting the extra power we need from the Cat Engines, our fuel consumption has been reduced from 1700 gallons of butane per day to only 1300."

Switching engines in mid-hole is unusual. But the excellent performance obtained with Cat Natural Gas Engines is typical. The turbocharged and aftercooled G397 develops 560 continuous horsepower at 1200 RPM. (The 7.5:1 model G397 is rated at 415 HP @ 1300 RPM.) All Cat Natural Gas Engines have Caterpillar's Low-Tension Ignition System. Far more dependable than high-tension systems, Caterpillar's design has a magneto feeding low-tension current to high-tension transformers near the spark plugs. Very short high-tension leads provide a hotter, more positive spark with less losses.

You can always convert a Cat Natural Gas Engine to diesel and back again to operate on the available fuel. And, you can select exactly the engine *you* need with Caterpillar's long line of optional equipment.

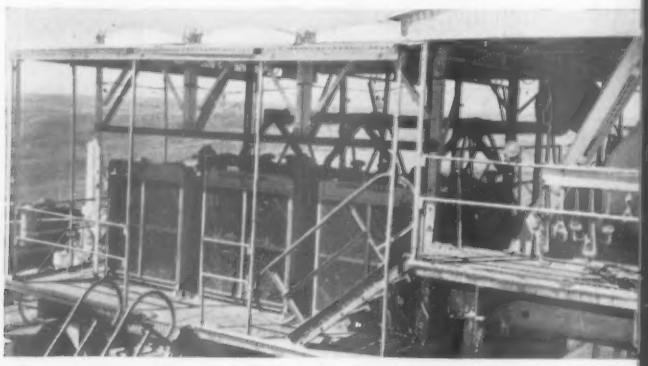
Before you install or repower oilfield equipment, investigate Cat Natural Gas Engines. Your Caterpillar Dealer will tell you everything you want to know about them. From there, it's an easy job to compare them against all others—and prove their superiority. Remember, too, to specify reliable Cat Engines when buying new equipment.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

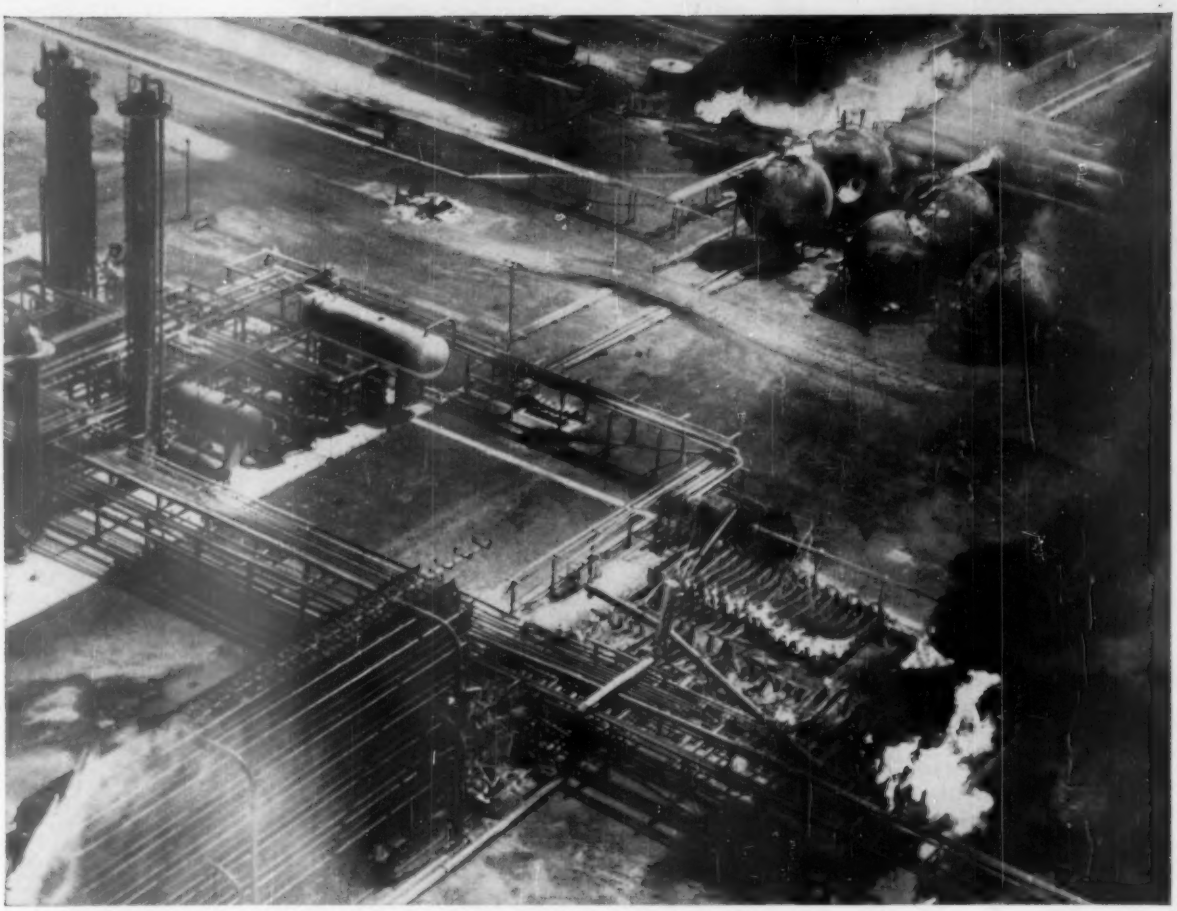
Engine Division, Caterpillar Tractor Co., Peoria, Ill., U.S.A.

Rig has 136-foot Lee C. Moore mast. Drilling will go to estimated 12,000-foot depth averaging 200 feet per day.



▲ Three Cat G397 Natural Gas Engines drive a compound powering draw works, rotary table, and two mud pumps.

▼ Engines began operation on butane, are now on field gases. They provided greater power on 23.5% less fuel.



WITHOUT ADEQUATE PROTECTION, this spectacular tank fire spread wildly and caused many thousands of dollars of refinery property damage.

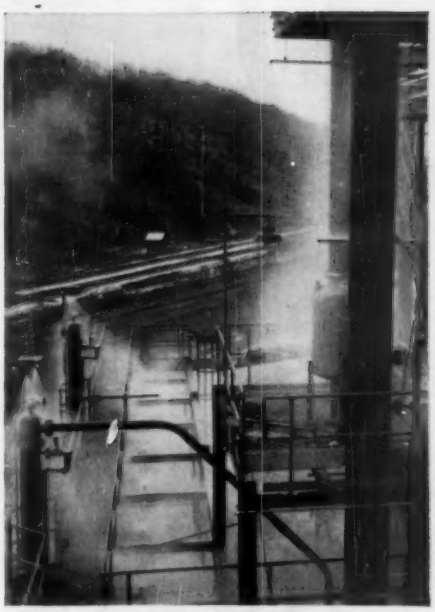
Keep tank fires from getting out of control with Grinnell Water Spray

Proper safeguards are uppermost in importance in protecting tanks which contain flammable gases and liquids in the event of fire. For example, tanks must be guarded against extreme heat exposure. Leaking gas, if it should develop, must be diluted to the point where it will not burn. And fire, if it should occur, must be localized and controlled or extinguished.

With a Grinnell Water Spray System, you get such protection.

Before heat raises tank temperatures dangerously, an enveloping spray of water provides instant cooling, reducing internal pressure which helps prevent rupture. In addition, air turbulence is created (even in still air) which, in conjunction with the water vapor from the spray, helps dilute the flammable vapors to control or extinguish the fire. Flammable products which cannot be safely extinguished can be safely burned off under the protecting water spray.

FREE REFERENCE MANUAL. For a comprehensive picture of all the most advanced methods of special hazard fire protection, request your free copy of "Special Hazard Fire Protection by Grinnell." Write Grinnell Company, Providence 1, R. I. Branches in principal cities.

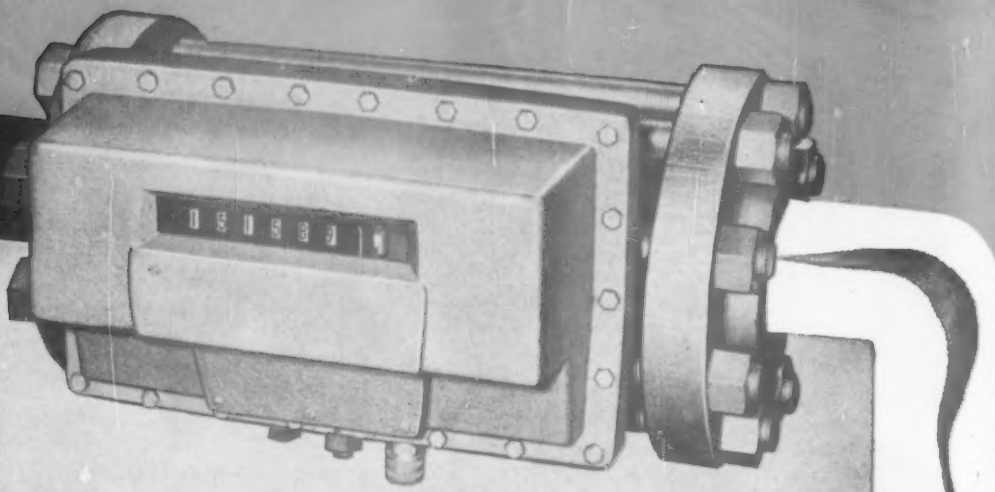


GRINNELL WATER SPRAY SYSTEM under test at the Marietta, Ohio plant of the Bakelite Union Carbide Plastic Company, a division of the Union Carbide Corporation. Water — when it is applied in time and distributed over the surfaces efficiently by a properly engineered system — is most effective in limiting tank fires and controlling their spread.

GRINNELL

FIRE PROTECTION SYSTEMS SINCE 1870

AVAILABLE NOW



AVAILABLE NOW

The BS&B-GE Gyro-Integrating True Mass Flowmeter For Natural Gas*

Gives Accurate Gas Flow Measurement Under Wide Variation of Flow Rates, Pressures, Temperatures and Densities

You've read about the True Mass Flowmeter for natural gas. Now, you can put this accurate measuring device to work for you.

True Mass measurement eliminates the problems associated with varying gas densities, super-compressibilities and other physical properties. Measures directly and precisely the gas flow rate in pounds. Readily adapted to automation.

The BS&B Mass Flowmeter makes possible new economies at nearly every level of natural gas measurement. You get large savings not only from reduced calculating time but also from increased accuracy in gas accounting.

Gyro-integration in the meter eliminates chart handling and chart-integration by planimeter. The small, light, self-contained meter is ready for installation — no meter run is required. It's simple to operate and has long service life.

Get highest accuracy from this newest development in mass flow measurement. To prove this meter out for the natural gas industry, BS&B constructed a special prover facility which is believed to be the first positive prover for gases. For your specific application, write . . .

OVER 60 YEARS
BS&B
EFFICIENCY RELIABILITY
ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

BLACK, SIVALLS & BRYSON, INC.

Mass Flowmeter Sales, Dept. 3-A10 P.O. Box 1714, Oklahoma City, Oklahoma

*Manufactured by General Electric
Calibration, Sales and Service by BS&B*

ALLEN-BRADLEY

Quality Control Centers

...the mark of a modern plant providing the utmost in reliability, safety, convenience, and lasting beauty

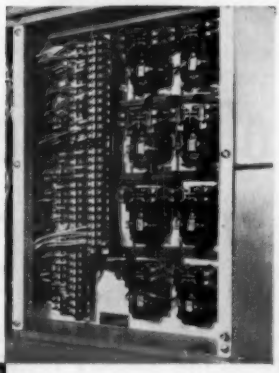
The superior *quality* of Allen-Bradley control centers provides a modern and attractive installation—one that you'll be justly proud to have in your plant. The cost is commensurate with the quality of the workmanship—but you'll never have reason to regret your decision. Furthermore, Allen-Bradley control centers arrive completely wired and tested—and *installed* costs are usually substantially lower than that of individual starters.

The flexibility of A-B control centers makes them readily adaptable to changing needs. Individual units can be added or modified without internal rewiring. In addition, entire sections can be added to meet future plant expansion.

For the finest in control centers, you cannot surpass Allen-Bradley's Bulletin 798. Write today.

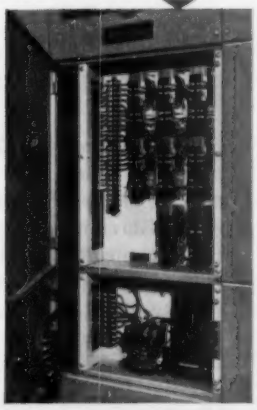
Allen-Bradley Bulletin 798 Multi-Unit Control Center

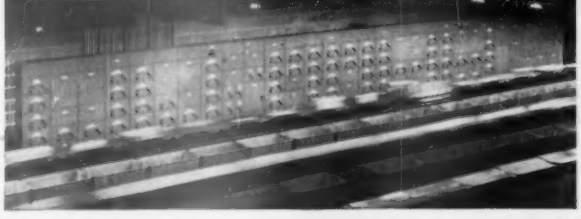
This shows A-B control center unit with popular A-B Bulletin 709 solenoid starter and circuit breaker.



This shows A-B Bulletin 700 control relays mounted in an A-B control center unit.

A-B control centers can be equipped with a wide variety of components. These Bulletin 849 timers are used on an automatic conveyor line.





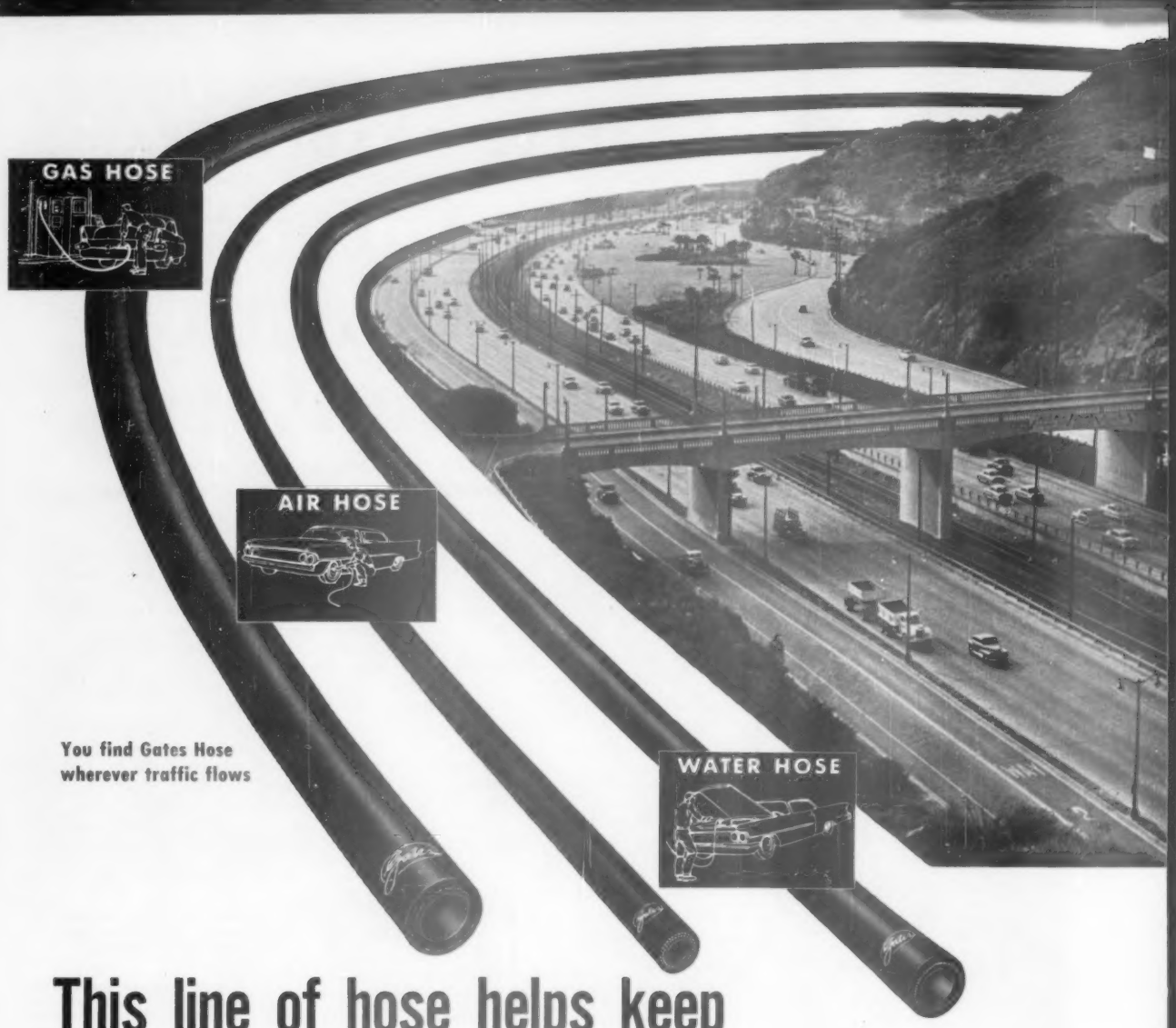
This huge, 48-foot A-B control center houses 101 A-B Bulletin 709 solenoid motor starters. It is designed to permit an addition containing 50 more Bulletin 709 starters.

ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1344 S. Second St., Milwaukee 4, Wis., U. S. A. Canada: Allen-Bradley Canada Ltd., Galt, Ontario

QUALITY MOTOR CONTROL



You find Gates Hose wherever traffic flows

This line of hose helps keep 70,000,000 vehicles on the move

To service some 70 million motor vehicles with gas, air, water and grease, this nation's 183,000 service stations use uncounted miles of hose. Because Gates is a major manufacturer of industrial hose, thousands and thousands of these stations rely upon Gates Curb Pump Hose, High Pressure Grease Hose, Air, Water and Low Pressure Steam Hose.

In back of this broad acceptance of Gates Hose is a continuing program of specialized hose research at the multi-million dollar Gates Research Center. The aim of this *specialized research* is to increase hose utility, lengthen hose life and lower industry's annual hose costs.

Because Gates Hose is so widely preferred, it is quickly available from leading distributors in all industrial centers. These Gates Hose Distributors are listed in the phone book Yellow Pages.

TPA502

The Gates Rubber Company

The Mark of *Specialized* Research

Gates Industrial Hose / Made in a Full Range of Types and Sizes

You save drilling dollars with a Baroid Mud Program

THE MUD PROBLEM AND ITS SOLUTION

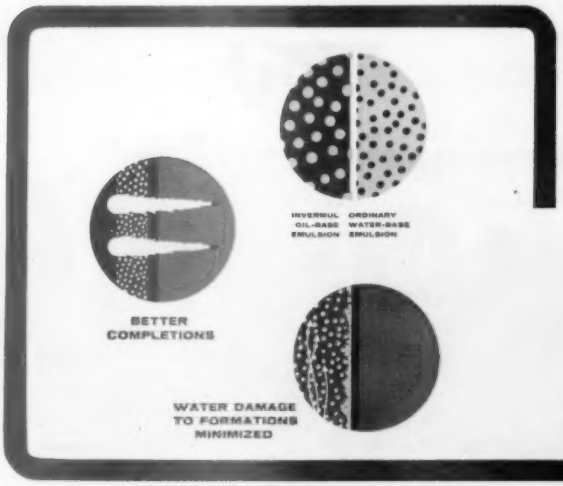
INVERMUL*

When the problem is selecting an oil-base emulsion mud to protect formations against water damage, INVERMUL is the answer. INVERMUL invert emulsion mud prevents water damage to formations, is easy to make up and maintain and has high tolerance against contaminating water base mud.

In Sublette County, Wyoming a well was drilled to 9323′ with conventional mud. Surface casing only was set at 506′. Hole from 506′ to TD was drilled with 7⅞″ bits. At a depth of 9,323′ caliper survey showed that the hole had enlarged to an average of 12″ diameter. Operators wished to protect the deeper Mesa Verde formation against filtrate water damage.

INVERMUL, oil base emulsion mud, was selected to best accomplish the objective. The result was trouble free drilling to Total Depth of 11,564′.

INVERMUL is a concentrated emulsifier for making stable water-in-oil emulsion muds using either crude or refined oils. INVERMUL mud is an outstanding example of how Baroid's new streamlined, integrated program gives you engineered drilling mud to meet the most difficult drilling problems.



BAROID

BAROID DIVISION NATIONAL LEAD COMPANY

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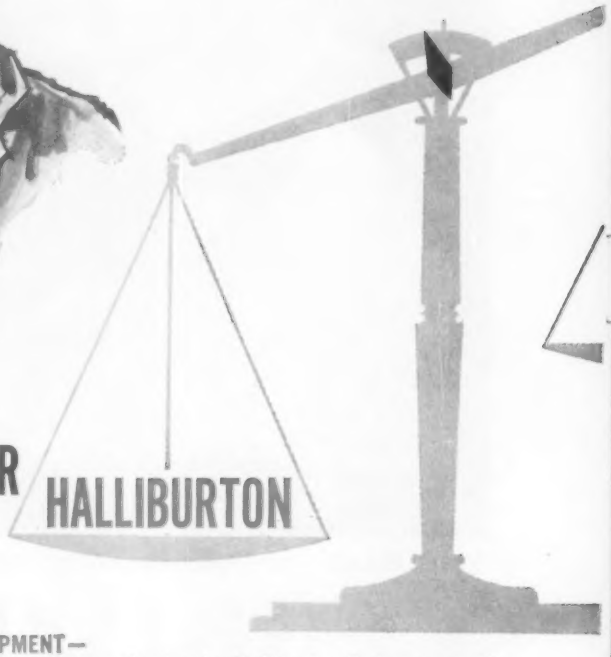


IN ACIDIZING . . . THE FACTS FAVOR HALLIBURTON

When the need for improving the production rate of your well points to *acidizing*, your next step – selecting the service company – can be the key to a successful job. Here are some of the important factors that make Halliburton your *best choice* for the job:

PEOPLE –
The greatest single asset a company can offer its customers! The people who make up the Halliburton team provide your first list of benefits – training, skill, ability . . . and experience!

MATERIALS –
In selecting the chemicals to put into your acidizing job, you get the benefit of Halliburton's ability to choose the *best* materials from chemical manufacturers all over the world . . . not just a single source.

EQUIPMENT –
Engineered *from the start* by Halliburton designers specifically for oilfield service . . . built by Halliburton craftsmen . . . operated and maintained by experienced Halliburton field crews.

FACILITIES –
Strategically located throughout the free world . . . backed by the most extensive research and chemical laboratories of *any* oilfield service organization.

Specify Halliburton for your next acidizing project . . . and get the benefits of a completely coordinated service organization geared to do the job – large or small – with speed, efficiency . . . and at reasonable cost. See your nearby Halliburton Representative.

REGULAR ACID *The Principal Ingredient*

Halliburton Regular Acid, a mixture of Hydrochloric Acid and inhibitor, is the basic ingredient in many of Halliburton's chemical treating solutions for production improvement. Where applicable, HCl acid is the most economical approach as an aid for improving permeability in calcareous formations. It is also used as a conditioning agent prior to other types of well treatments.

PENETRATING ACID *For Low Surface Tension*

Penetrating Acid contains a surface active agent which tends to lower breakdown pressures in dense formations by imparting better "wetting" properties. The solution is designed for easier return of spent acid which is often needed in low pressure formations.

NE ACID *To Help Prevent Acid/Oil Emulsions*

In many instances, native crudes contain traces of emulsion stabilizers. Blended agents for Halliburton NE Acid aid in preventing emulsification of the crude with acid or spent acid.

HV ACID *Delayed Action For Better Results*

With additives, acidizing solutions can be "tailored" as true acidgels or as acid-in-oil emulsions. Each has controlled, increased viscosities for chemical retardation resulting in deeper penetration of unreacted acid. Formation characteristics determine the selection of the treating solution.

Fe ACID *An Aid to Preventing Re-deposition of Solids*

Fe Acid is particularly suited for use in disposal and injection wells. Normally, an encrustation of solids, primarily iron compounds, plate out on the formation adjacent to the well bore – obstructing the permeability. This acid is designed to remove these solids and deter their re-precipitation within the formation.

ALC-5 ACID *Low Fluid Loss Additive For Acid*

This additive is an economical approach to obtaining a retarded effect in any type of Halliburton acid solution. A more lateral movement of acid during treatment can be obtained with the Acid Loss Control agent covering a greater drainage area.

HF ACID *A Mud Removal Solution*

This surfactant-carrying mixture of hydrochloric and hydrofluoric acids is a low surface tension solution designed for the removal of mud or other silicate deposits that are restricting permeability. It is used most often in siliceous formations.

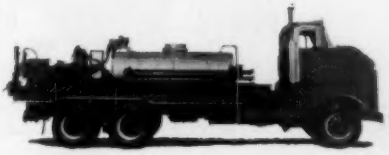
GYP REMOVAL SOLUTION *An Acidizing Approach*

This two-stage treatment is designed to chemically remove gyp scale which is normally insoluble in acid. The first stage treatment converts the scale to a chemical compound which can be removed by the second stage . . . a conventional acidizing treatment.

YOUR NEARBY HALLIBURTON REPRESENTATIVE WILL BE GLAD TO GIVE YOU MORE INFORMATION. CALL HIM SOON!

HALLIBURTON CHEMICAL SERVICES

HALLIBURTON COMPANY • DUNCAN, OKLAHOMA



275 SERVICE CENTERS . . . JUST MINUTES AWAY FROM YOUR WELL

Memo to Management:

TO PUMP
OR NOT TO PUMP ***EFFICIENTLY***
IS THE QUESTION
and PEPA has the answer

The question of dependable, efficient power for oil field pumping has been answered time and again with economical utility electric power. In most instances there is no substitute for the savings in maintenance, money and manpower provided through the use of purchased electric power. And this record of efficiency is not restricted to any one section of the petroleum industry. From the oil fields to the refinery it will pay you to investigate possible savings you may derive. Contact your Utility Electric Power Company for details.

A list of P.E.P.A. members will be furnished on request

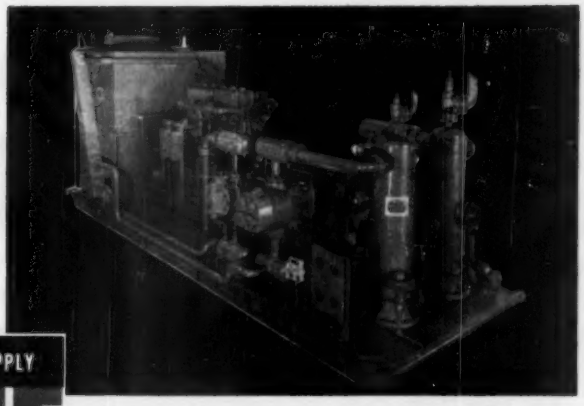
PETROLEUM POWER ELECTRIC ASSOCIATION

BOX 35006, DALLAS 35, TEXAS

NEW

WILSON SUPPLY

INGERSOLL-RAND



HHE PACKAGED

COMPRESSORS

Favorite in the Field

The **new** Wilson Supply-Ingersoll-Rand HHE packaged compressor is already a favorite with many operators. Installation costs are less because the unit's opposed cylinder design practically eliminates vibration. Operators have found the HHE a flexible unit, too. It can handle a wider range of field applications with its low and high stage "controller clearance" liner-type cylinders.

The HHE unit is becoming the favorite in the field, and currently units are handling a variety of field applications in Oklahoma, Kansas, New Mexico and Texas.

For complete information on the Wilson Supply-Ingersoll-Rand HHE packaged compressor, contact your nearest Wilson Supply store or write: Compressor Division, Wilson Supply Co., P. O. Drawer 19, Houston. Please give suction, discharge and volume to be handled.

"WHAT YOU WANT – WHEN YOU WANT IT"

INTERNATIONAL DIVISION • 45 ROCKEFELLER PLAZA • ROOM 1701, NEW YORK

BRANCH STORES—SOUTH TEXAS: Alice, Barbers Hill, Bay City, Columbus, Corpus Christi, Houston, McAllen, Victoria. WEST TEXAS: Ft. Stockton, Kermit, Stanolind, Odessa, Pearl. EAST TEXAS: Beaumont, Kilgore, Liberty. LOUISIANA: Harvey, Houma, Lake Charles, New Iberia, Shreveport. NEW MEXICO: Hobbs. SALES OFFICES—DALLAS, SHREVEPORT, SAN ANTONIO, TULSA, NEW ORLEANS, LAKE CHARLES, MIDLAND, LAFAYETTE.

WILSON SUPPLY CO

HOUSTON, TEXAS

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Move the man off the monkey-board

GUIBERSON

*Type **H** Hydraulic*

WIRE LINE OIL SAVER

Hydraulically operated, Guiberson's Type H Wire Line Oil Saver is controlled remotely by applying or releasing hydraulic pressure through a 50′ hose from pump to saver. The Type H effectively and uniformly cleans the wire line. This keeps the working area and equipment free of well fluids, reducing the hazards of fire and accident. Comply with Guiberson's slogan, "Better Be Safe Than Sorry," by using the Type H. There is no need for a man on the monkey-board during swabbing and redressing operations, which should please your insurance company.

Advantages of Type H Saver:

Hydraulically operated by field-proved piston principle . . no trouble-causing rubber bladders or complicated mechanism.

Large rubber and generous bushings give a smooth, constant seal. Rubber can be used until almost completely consumed.

Ram has 2½" hydraulic stroke with spring-actuated return.

Non-sparking, durable split bushings . . top and bottom interchangeable.

Saver is quickly and economically redressed at top of unit . . no threaded connections.

Bushings and rubbers for ⅜" to ⅝" or ¾" to 1" line.

Remotely controlled . . allows at least 50′ leeway from saver to pump.

For swabbing, gun perforating and other wire line operations, put the Type H to work. Ask your Guiberson man for a demonstration.

Long-life packing rubber and bushings.
Corrosion-resistant brass body.
Pressure gauge with marked operating ranges also indicates degree of rubber wear.
Hand controlled pressure relief valve.
Redressing tool.
Hydraulic pump with base.
Convertible to any field connection by changing only the base.
Fluid-filled 50-foot hose with check valve each end.

Sold by Oil Field Supply Stores Everywhere

THE GUIBERSON CORPORATION
DALLAS, TEXAS, U. S. A.

PRODUCTION, DRILLING AND WORKOVER SPECIALTIES, MOLDED RUBBER PRODUCTS

DRESSER INDUSTRIES INC.
OIL • GAS • ELECTRONICS
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chemicals on the move... sulfuric acid

A realistic and dependable examination of your sulfuric acid supply is essential for buying to best advantage. We will be glad to help develop this study taking into consideration your specific location, transportation methods, and spent acid recovery factors.

Olin Mathieson supplies all commercial grades from Baltimore; Little Rock; Bossier City, La.; and Beaumont, Port Arthur and Pasadena, Texas. For complete information or safety and handling instructions, see your district representative or write.

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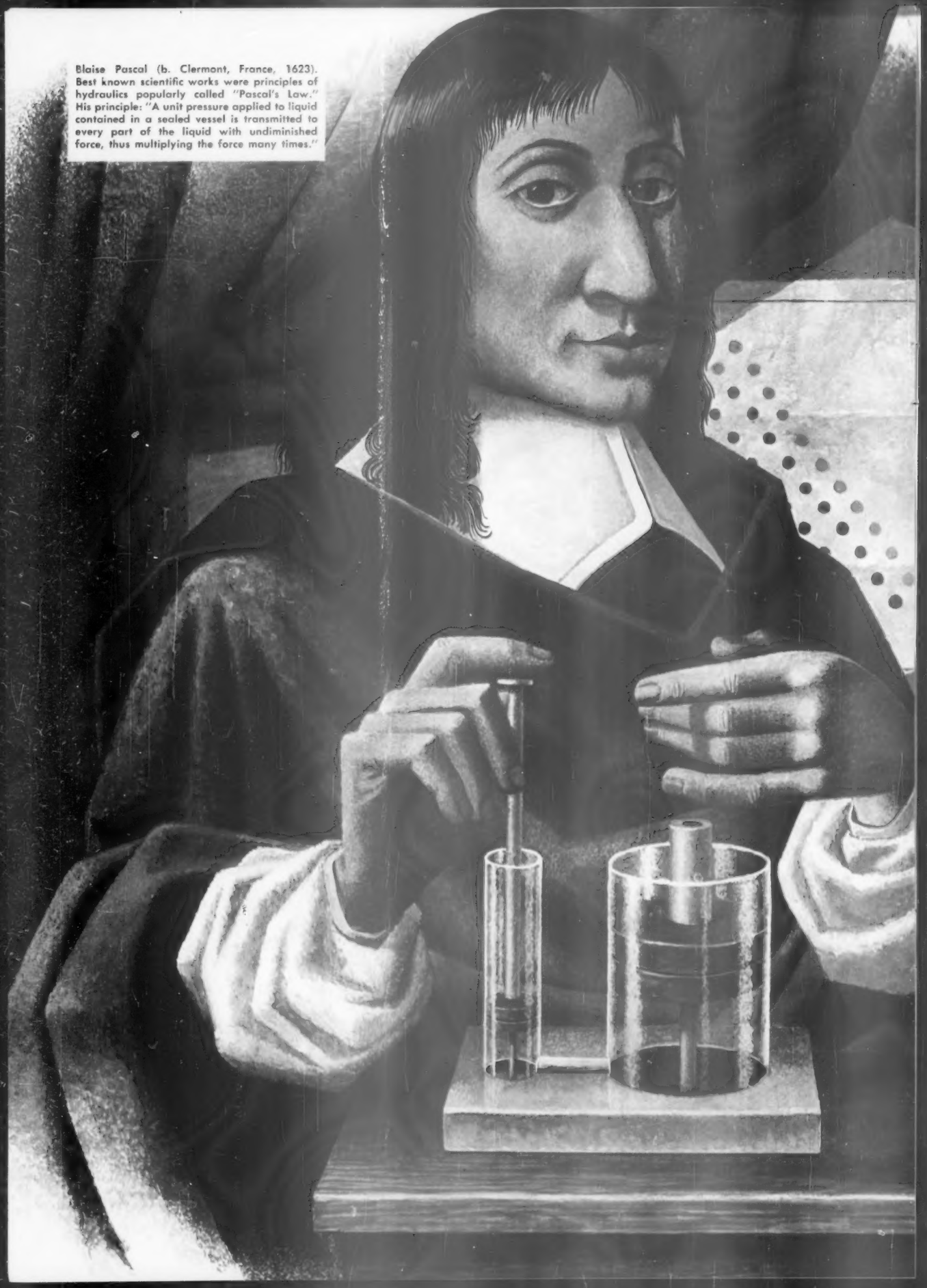
AMMONIA • BICARBONATE OF SODA • CARBON DIOXIDE • CAUSTIC SODA • CHLORINE • FORMALDEHYDE • HYDRAZINE AND DERIVATIVES • HYPOCHLORITE PRODUCTS • METHANOL • MURIATIC ACID • NITRATE OF SODA • NITRIC ACID SODA ASH • SODIUM CHLORITE PRODUCTS • SODIUM METHYLATE • SULFUR (PROCESSED) • SULFURIC ACID • UREA



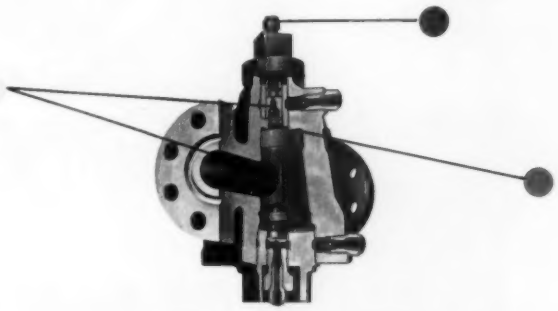
Blaise Pascal (b. Clermont, France, 1623). Best known scientific works were principles of hydraulics popularly called "Pascal's Law." His principle: "A unit pressure applied to liquid contained in a sealed vessel is transmitted to every part of the liquid with undiminished force, thus multiplying the force many times."

he gave the world new muscles

. . . and his idea helped give you a better valve

Blaise Pascal, through applied hydraulics, freed man from total dependence on his own muscles and the brute strength of animals. The list of modern devices that rely at least in part on hydraulics to multiply power is almost endless.

A perfect application of Pascal's principle is the Rockwell-Nordstrom lubricated plug valve. In it, *pressurized* lubricant jacks the tapered plug minutely from its seat to keep it free for instant ¼-turn operation. And pressurized lubricant in the Sealdport® grooves between the valve body and plug also creates powerful, positive seals against leakage . . . seals that can't be damaged like the exposed seats in other valves. For additional reasons why Rockwell-Nordstrom lubricated plug valves will give you better flow control at lower cost, examine the cutaway illustration below.



PERFECT APPLICATION OF A PRINCIPLE

- Lubricant quickly, easily injected through Rockwell fitting.
- Lubricant travels through Sealdport® system to create powerful seals against leakage and prevent metal-to-metal wear between plug and body . . . note seats never exposed to the line.
- Lubricant hydraulically jacks plug minutely from seat for instant quarter-turn operation.

Rockwell-Nordstrom is the original and world's most complete line of lubricated plug valves. Available in sizes from ½" to 36" and pressures to 15,000 lb. For additional information, see your supplier or write: Rockwell Manufacturing Company, Pittsburgh 8, Pennsylvania. Canadian Valve Licensee: Peacock Brothers Limited. If you live outside the USA, write: Rockwell International S.A., Geneva, Switzerland.

Lubrication Makes The Difference

ROCKWELL-Nordstrom VALVES

another fine product by

ROCKWELL

Heralding

This Knight-at-Arms Licks Oil Problems!

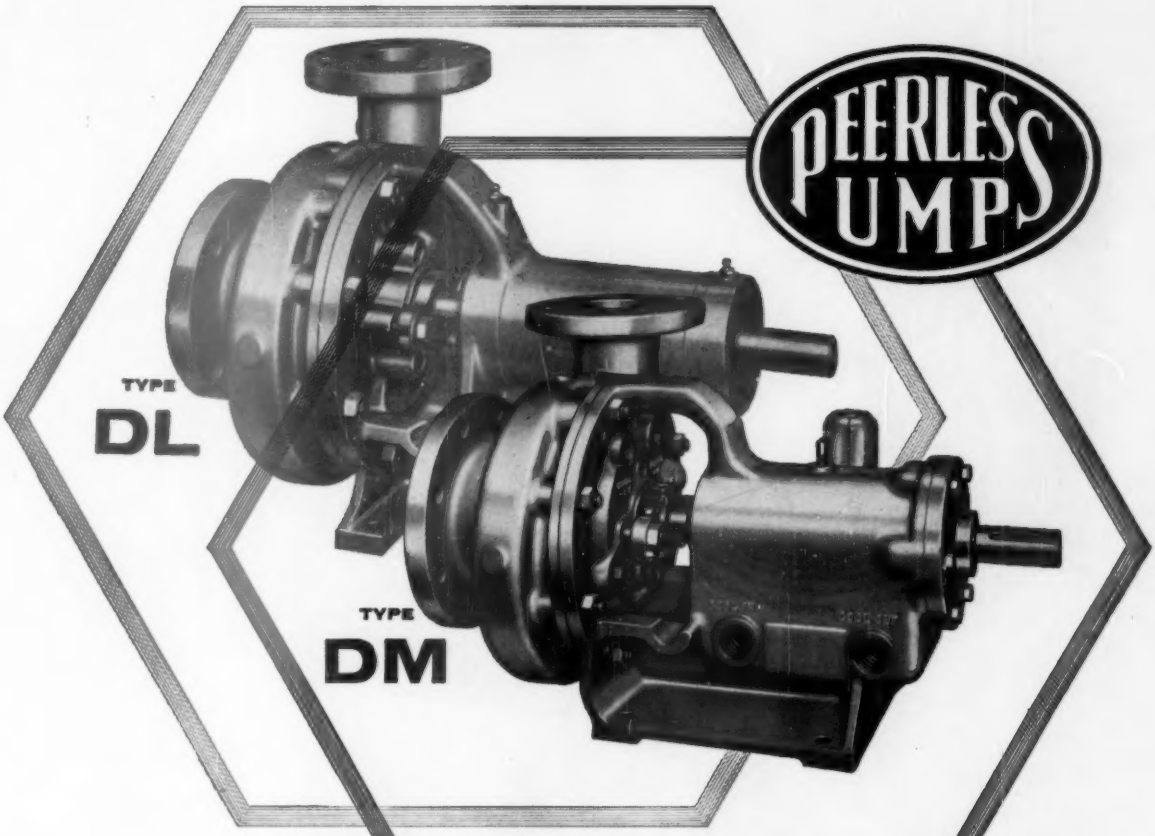
This versatile oil man-engineer-banker who heads our oil department, helps our correspondents in many a head-on clash with oil problems. As the crest shows, he's from the "show-me" state, too, which is why he's good in his business! Remember, First of Tulsa has one of the oldest, most experienced oil departments in America . . . with one of the largest oil credit files — for **better** oil banking — just . . .

Think... 1st of Tulsa

FIRST NATIONAL BANK AND TRUST COMPANY

SINCE 1895

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION



a new concept of economy through interchangeability of components!

PEERLESS PUMPS

INTEGRATED ∫ DESIGN

∫ SUPERIOR DESIGN + TOP QUALITY CONSTRUCTION + MAXIMUM INTERCHANGEABILITY + OPTIMUM MATERIAL GROUPS AVAILABLE

= BROADEST HYDRAULIC COVERAGE WITH MINIMUM CUSTOMER INVENTORY OF PUMPS AND COMPONENTS

ACCESSIBILITY—Through ease of assembly and disassembly if and when required. **DURABILITY**—Through use of any machinable metal as materials of construction. **SERVICEABILITY**—Through designs that feature maximum ease of maintenance. **INTERCHANGEABILITY**—Through a choice of semi-open or enclosed impellers, oil or grease lubrication, air- or water-cooled back plates and bearing housings. **RELIABILITY**—Through the high performance standards set for these pumps, proving more than ever before, that Peerless Builds Dependable Pumps. **AVAILABILITY**—Shipment from stock of both complete pumps and pump components.

CAPACITIES: UP TO 1000 GPM • **WORKING PRESSURE:** UP TO 300 PSIG
HEAD RANGE: UP TO 430 FEET • **TEMPERATURE RANGE:** UP TO 450° F

Putting Ideas to Work

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Peerless Pump
HYDRODYNAMICS DIVISION

Offices:
New York; Detroit; Cleveland; Chicago; Indianapolis; St. Louis; San Francisco; Atlanta; Plainview; Lubbock; Phoenix; Albuquerque; Los Angeles; Fresno.

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Peerless Pump, Hydrodynamics Division, Food Machinery and Chem. Corp.

"The changes of the '50s will be dwarfed in the coming years . . . rockets will become commonplace; electronics will further revolutionize computation and automatic controls. Science has big breakthroughs in the test tubes and on the drawing boards. The people of the earth want more of everything, want it better, and want it soon."

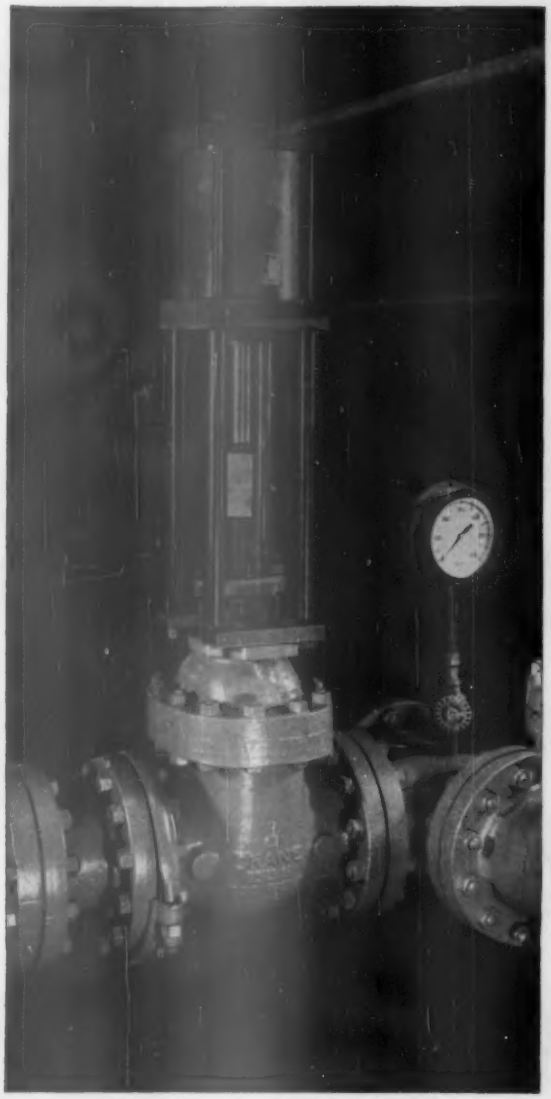
—Leo D. Welch, Chairman of the Board

Standard Oil Company (New Jersey)

CRANE
DIRECTION '70

... a fast-moving program of planned expansion, product development, and streamlined distribution to help our customers meet the competitive challenges of the Sixties.

NEW CRANE CYLINDER OPERATORS— LOW-COST POWER OPERATION FOR GATE VALVES



Now you can control any flow process easier and faster with cylinder operated Crane valves. Large valves . . . valves in remote or inaccessible locations . . . valves that must be cycled many times a day . . . all these can now be operated at the touch of a finger, saving time and manpower. These benefits of power operation are available from Crane now—at lower cost and in less time than ever before!

Crane cylinder operators are available for Crane O. S. & Y. iron body wedge and double-disc gate valves, and for pulp stock valves. Control devices for local or remote actuation supplied at extra cost.

And you can get these new operators for modernization of your present Crane gate valves, too. Easy-to-install adapter is shipped with every cylinder. Field installation can be done in 30 minutes or less, without removing the valve from the line.

This new valve operator is another example of how Crane solves your flow problems more economically, more productively. The Crane solution —the right answer to your flow problems—is as close as a phone call to your Crane distributor. Call him today.

CRANE®

CRANE CO., INDUSTRIAL PRODUCTS GROUP
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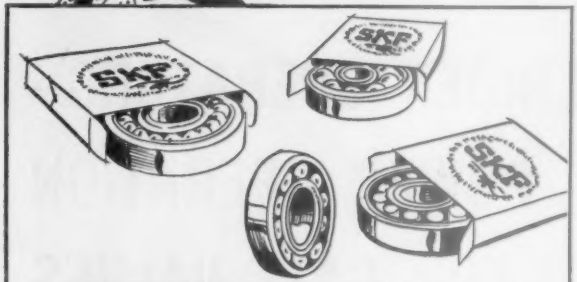
Valves • Electronic Controls • Piping • Plumbing
Heating • Air Conditioning • Cyclotherm® Boilers • Heat
Exchangers • Marine Products • Powdered Metals

DISTRIBUTOR DAN, the SKF bearing man, shows

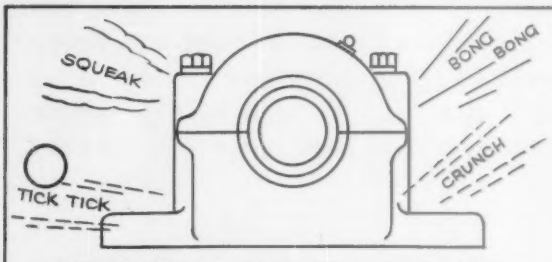
HOW TO CHECK BEARINGS DURING RUN-IN

—to prevent damage and downtime later!

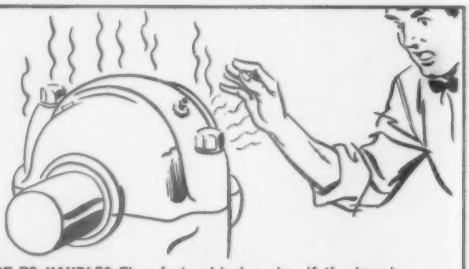


THINK BEFORE YOU INSTALL THEM. The first few hours of operation are the most critical in a bearing's life. So, operate the bearing at reduced speed and load during run-in. Bearing run-in periods vary from a few hours to a few weeks, but 24 hours is usually sufficient.

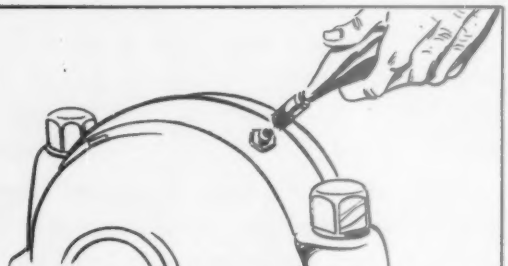
NOISE CAN BE A SYMPTOM. A soft, purring sound is all you should hear from a bearing—if it's operating correctly. Check by placing the blade of a screwdriver and listening at the handle. Any other noise means trouble sooner or later.



KNOW YOUR NOISES. Squeaking means inadequate lubrication. Metallic tones indicate shaft or housing interference or improper adjustment. Smooth, clear tones tell of marks in the stationary raceway. Intermittent noises indicate a damaged ball. Crunching means dirt.



TOO HOT TO HANDLE? There's trouble brewing if the housing feels excessively hot. High temperature usually indicates overlubrication or use of a lubricant with too high viscosity. It can also be a sign of excessive axial or radial preloading, misalignment, tight-fitting seals, or rubbing.



PREVENT TROUBLE BY DOUBLE-CHECKING. Always check the bearing after the critical run-in period. Examine the lubricant. If it's dirty, change it. Check the seals for signs of wear or damage. A few minutes spent double-checking now eliminates chances of costly damage and downtime later.

Baffled by a bearing problem? Whether it's selection, mounting or maintenance—consult your Authorized SKF Distributor. He's staffed to help you keep them running smoothly and he stocks all the bearing types and sizes you need.

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Spherical, Cylindrical, Ball, Tyson® Tapered and REED Miniature Bearings

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1961's GREATEST SHOW ON WORTH!!!

1961 CHEVROLET STURDI-BILT TRUCKS! PROVED WORTH MORE BECAUSE THEY WORK MORE

A gigantic advance in trucking began just a year ago, when the first Torsion-Spring Chevy nosed out onto a highway. With a vastly different truck design, featuring torsion-bar independent suspension, this totally new Chevy did just about everything better. And it caught on fast. So fast, in fact, that already there are nearly 300,000 Torsion-Spring Chevies putting out this new kind of working ability on tough jobs all over America. Now, for 1961, Chevrolet introduces trucks with even more of the worth-more, work-more performance that's won such wide owner acclaim over the past year. Even more strength, even more stamina—and an even wider range of models!

MORE MODELS THAN EVER BEFORE! 189 models—work-proved dollar savers in every weight class! 1961 Chevies for every hauling chore in the book include three new long-wheelbase 4-wheel drive models, sturdy Stepside and Fleetside pickups, spacious panels, versatile Suburban Carryalls, handy Step-Vans and forward control chassis, tough chassis-cabs of all sizes, mountain-moving tandems. Somewhere in this long, *long* line is the one truck that makes the most sense on your job!

OWNER-PROVED TORSION-SPRING RIDE! It puts an end to I-beam axle shimmy! Independently suspended front wheels step right over bumps, tough torsion-bar springs soak up jolts. New smoothness speeds up schedules, cuts truck wear and maintenance expense, reduces cargo damage and driver fatigue. Owners report that there's never been anything like it for high-profit hauling!

STRONG, ROOMY CABS THAT HELP BOOST YOUR WORK OUTPUT! Rangy drivers ride in comfort with extra hip room, leg room and head room. Seeing is safe and easy through a whopping big wraparound windshield. The seat's a beauty, too—a full 59½" wide with a spring combination inside that gives just the right support. (And for the last word in working comfort, special 6" foam rubber padding is optional at extra cost.) And the *rugged* cab build includes all-steel construction, double-panel roof and double-walled cowl housing.

TOUGH TRUCK CHASSIS—BRAWNY BASIS FOR BIGGER PROFITS. Massive, truck-built frames add stamina to every chassis. In medium- and heavy-duty models, rugged self-adjusting variable-rate rear springs help smooth out big-tonnage hauls. Quality features galore boost truck life: Extra-big brakes give faster, surer stops and last longer. Precision wheel balance makes steering easier, lengthens tire life. Smooth, durable Synchro-Mesh transmissions come in sizes to suit all types of duty.

ENGINES WITH PROVED EARNING POWER. Famous sixes that out-sell all others because they're best at brightening cost records . . . big V8's that lead the industry for short-stroke design and hard-working durability! Chevy for '61 offers a *long* line of power plants to meet the special needs of every weight class.

The truth is, we could fill every page in this magazine with reasons why Chevrolet trucks have never been better than they are for '61, but there's no need for that. Not when your Chevrolet dealer can boil it all down for you so quickly and pleasantly. See him soon and start saving soon! . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

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92%

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OIL COMPANIES USE
MAGCOBAR
DRILLING MUD
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All around the world it has been conclusively demonstrated that Magcobar's better-engineered drilling mud products reduce unnecessarily high drilling costs. Wherever you are, a planned Magcobar mud program can mean faster drilling rate with less down time. And at the same time, a cleaner hole, better cuttings, better logging, and better cores can result.

The benefits of a good mud program, a *planned* Magcobar mud program, are reflected in total drilling cost. These benefits can extend even to better and more production without the use of stimulants.

On your next well, reduce hole time, speed up drilling, stabilize the hole, and reduce wear and tear on drilling equipment. You'll be in good company, too, right along with the 92 per cent of the world's oil companies who use Magcobar now. And you'll be helping yourself with the better-engineered mud products of Magcobar.

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Complete
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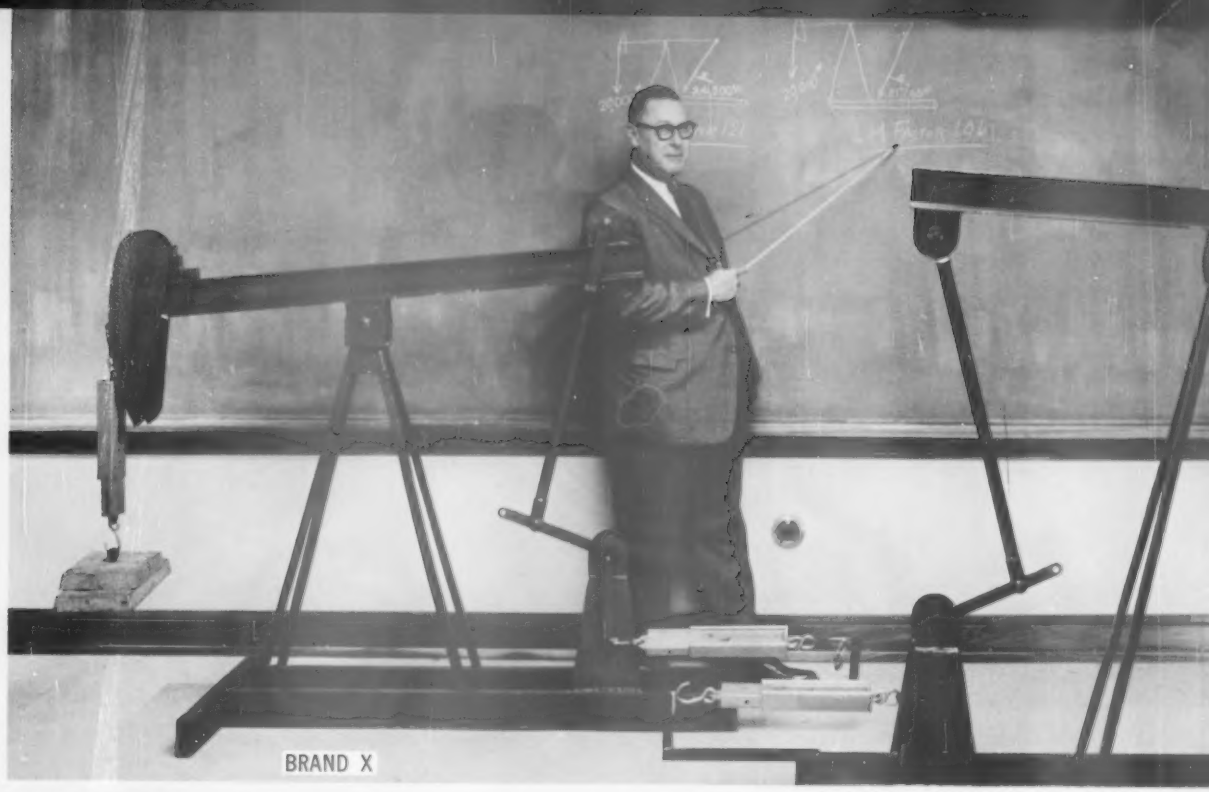
Well Done With Magcobar Technology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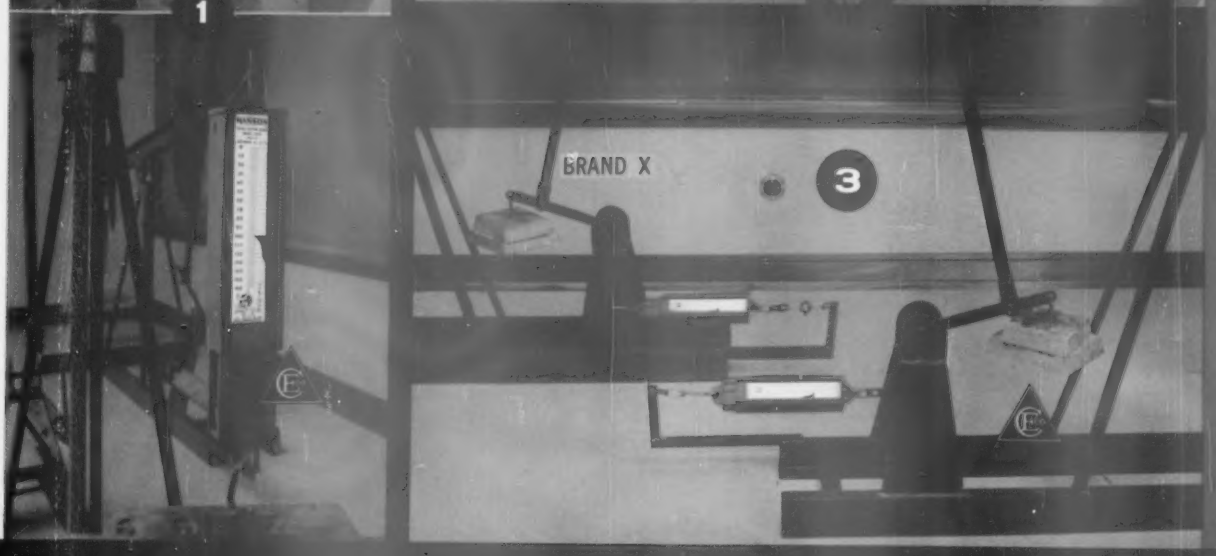
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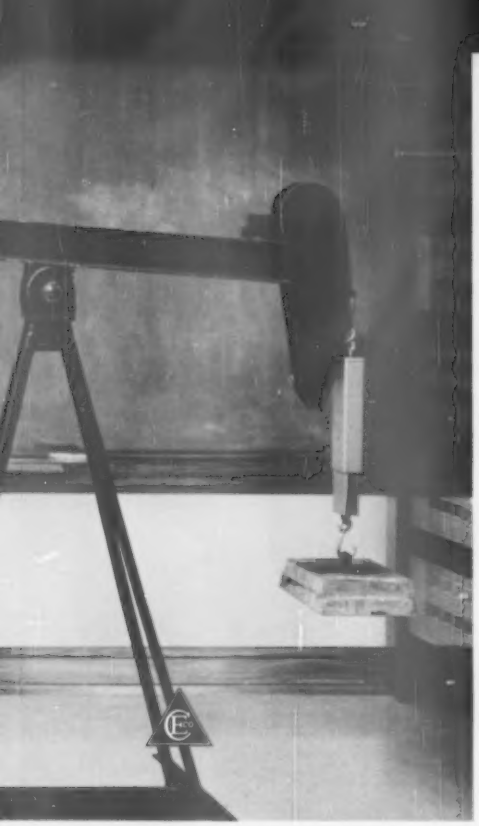


THIS SIMPLE DEMONSTRATION

.. makes it easy to see how C-E's low LMF (Load Multiplication Factor) cuts your operating costs.

See the two model units in the large photograph? The one on the right conforms to Continental-Emsco's design principles. Note its taller samson post. See how its added height reduces the angle between the pitman and a true vertical line. The smaller this angle, the less is your Load Multiplication Factor. This means you're pulling more vertically and more efficiently, as you'll see in the following example:

On the two models shown, a "well load" of 100 lbs. is applied. With the C-E-type model, the wrist-pin load is only 102 lbs. — a 1.02 Load Multiplication Factor. On the brand "X" model, the wrist-pin load is 119 lbs. for a 1.19 LMF. Seventeen pounds difference. Not much? It represents 16.6% more loading than on the C-E-type model.

To illustrate the advantages of good design, this demonstration is slightly exaggerated, to be sure .. but only slightly. Let's examine the figures from typical full-size unit pumpers and see what the LMF actually can mean to you:

On a 20,000 lb. well, a Continental-Emsco unit pumper with its LMF of 1.06 at its maximum stroke will produce a wrist pin load of only 21,200 lbs. Consider a competitive make with a 1.21 LMF actually being sold today. Here the same well load is increased to 24,200 lbs. at the wrist pin .. a ton and a half greater. Imagine the extra wear on gears, the excessive peak loads on purchased electric power, and the undue strain on belts and bearings!

Now you can see why so much time and effort went into the development of C-E's unit pumper design .. *to offer you the industry's lowest Load Multiplication Factor throughout the line.*

If you speak for your company's management, engineering, or purchasing departments, you should investigate the *many profit advantages* you gain with Continental-Emsco unit pumpers. Make it a point to see your C-E representative or write direct.

1

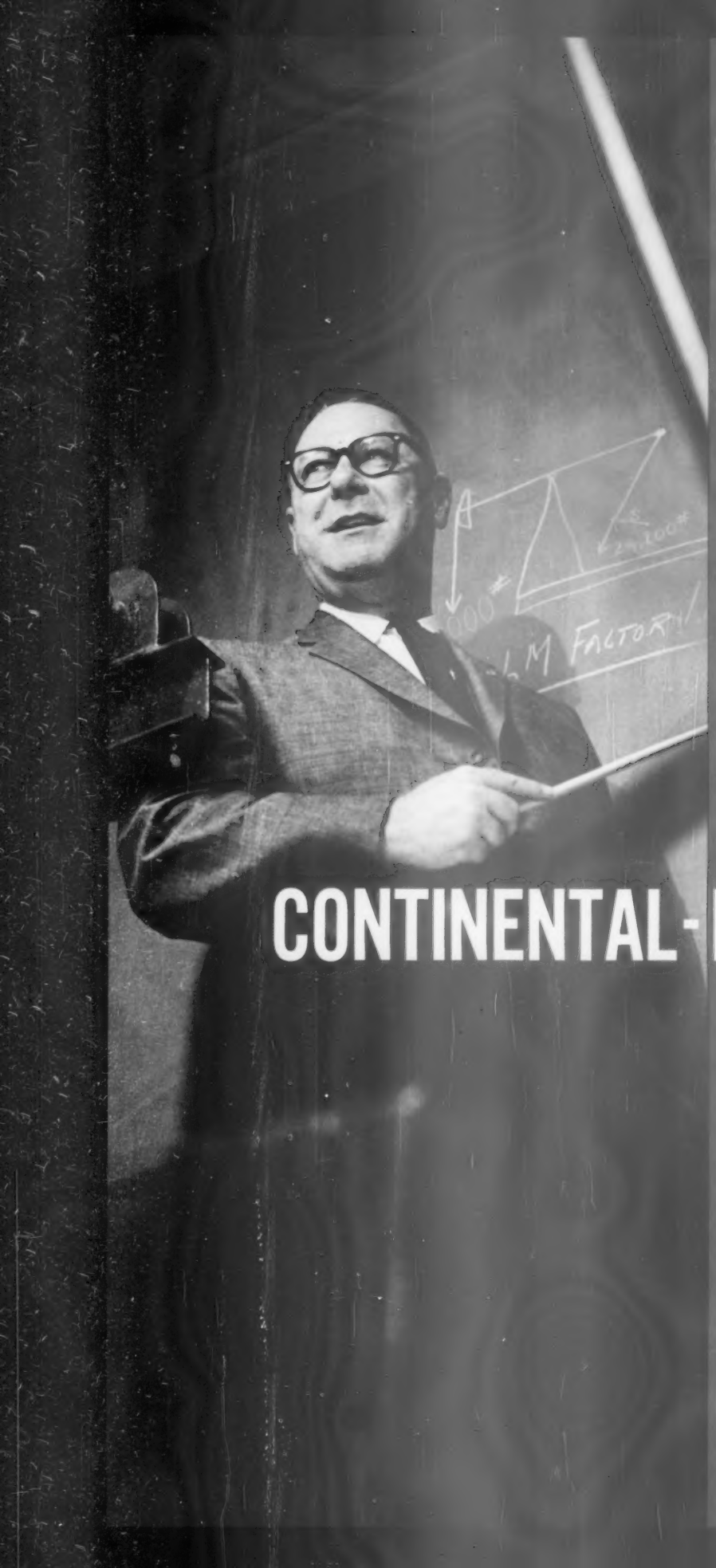
These two close-ups show spring scales on the two models in the large photograph. Both read 100 lbs. "well loads".

2

Spring scales attached to the wrist pins of the two models read: 102 lbs. for the C-E-type model on the right; 119 lbs. for the brand "X" on the left ... *over 16% greater wrist-pin load.*

3

With the well load remaining 100 lbs., 50 lbs. of actual counter-balance were added to each unit. The net load at the wrist pin on the C-E reads 54 lbs., while brand "X" reads 51 lbs., a 50% greater bearing and torque load. Obviously the efficiency of C-E's properly-designed unit pays off in lower operating costs, less wear on bearings and gear-teeth, and lower power costs —without over-sizing or purchasing added counterbalance effect.



LET'S TALK

ABOUT CONVERTING LIFTING COSTS INTO

PUMPING PROFITS

WITH

CONTINENTAL-EMSCO UNIT PUMPERS

Designed to meet the API standards

NOW LET'S TALK STRUCTURALS

In this unretouched double-exposure, you can see the advantages of Continental-Emsco's *triangular* samson-post design. Here, a load is held solidly by C-E's design, while a platform-type design buckles and flexes under the same load. The two units built of identical materials, are not scale models, but were constructed to demonstrate design principles. Here is a typical result of Continental-Emsco's Research & Development program . . continuing research into better methods of handling your well loads and power requirements with the *utmost utilization* of *each pound* of material.

OTHER FEATURES THAT SPELL ADDED RELIABILITY

FOUR-LEG TRIANGULAR CONSTRUCTION eliminates weaknesses caused by platform type samson-post design.

SUPERIOR LUBRICATION. Oil troughs cast in reducer case make inspection easier and provide ample amounts of oil at all speeds in both directions of rotation. Structural bearing lubrication available as follows: (1) Standard, from safety ring and ladder (2) ground lubrication (3) prelubricated and sealed at the plant.

BOLT-ON WRIST PIN HOUSINGS cut time for field assembly and stroke-length changes . . make them easier, too. Bolts assure accurate alignment. Pins are hydraulically removable.

PLUS WORLD-WIDE SERVICE AND SUPPLY . . backed by 134 stores and offices

B-10 BEARING RATINGS are your assurance of longer bearing life. Another C-E "first."

STANDARD QD SHEAVES cut cost and save time, since they are lower in price and readily available everywhere.

GROUND-LEVEL COUNTERWEIGHT ADJUSTMENTS make well balancing a simple, quick, safe . . and profitable job.

SERVICE BRAKE is a powerful, internally-expanding type and is located opposite drive sheave for easier adjustment and repairs.

VARIETY OF BASES AND SKID EXTENSIONS meets all prime-mover requirements and setting variations.

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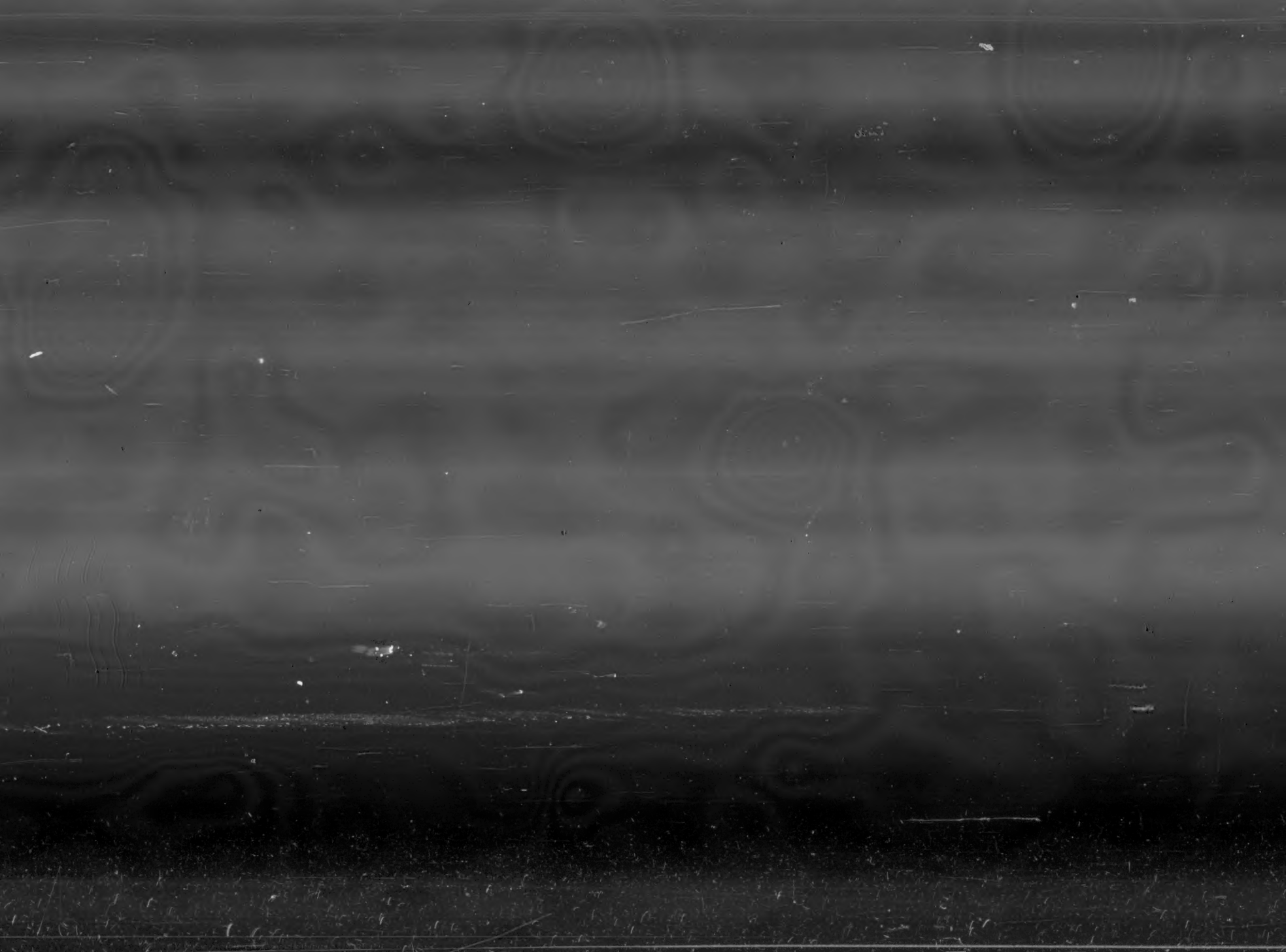

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VALVES

performance makes the world of difference

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Powell valves are performance-proven with 100 years of service to the oil industry. Powell offers valves in the greatest variety of sizes, designs, pressures, and metals to handle almost *every* flow control requirement of *every* industry. Contact your nearest Powell distributor. Or write to us. Our engineers and metallurgists are at your service to solve your valve problems!

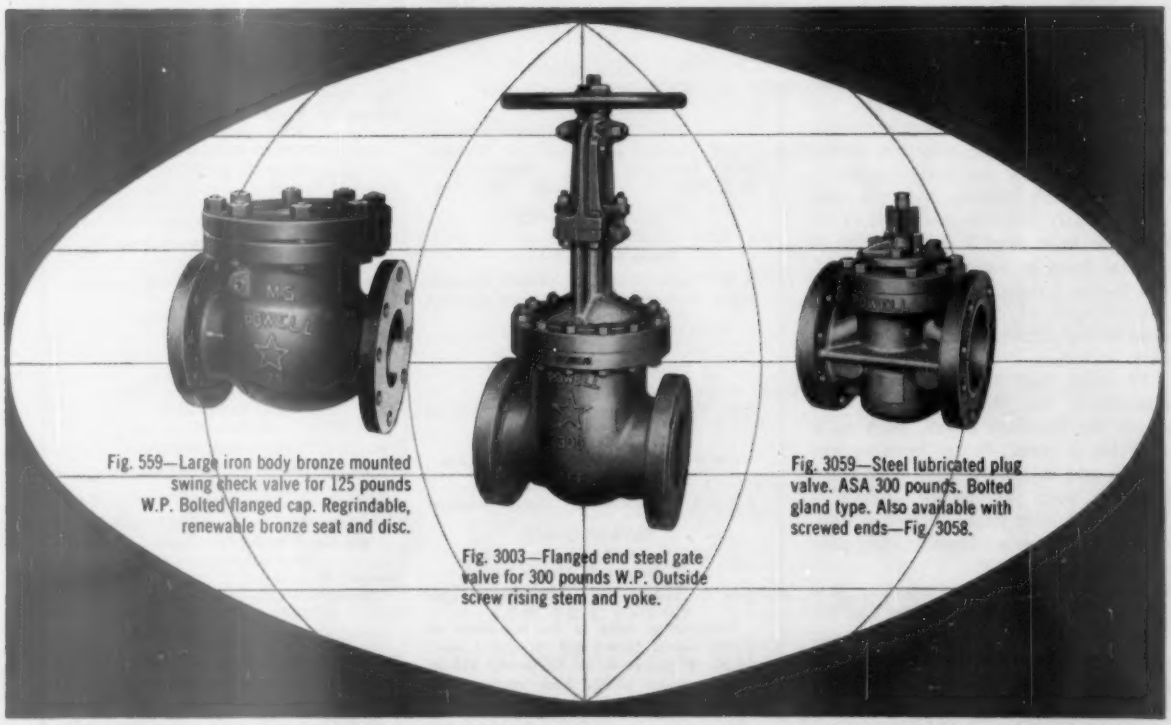

Fig. 559—Large iron body bronze mounted swing check valve for 125 pounds W.P. Bolted flanged cap. Regrindable, renewable bronze seat and disc.

Fig. 3003—Flanged end steel gate valve for 300 pounds W.P. Outside screw rising stem and yoke.

Fig. 3059—Steel lubricated plug valve. ASA 300 pounds. Bolted gland type. Also available with screwed ends—Fig. 3058.

THE WM. POWELL COMPANY • DEPENDABLE VALVES SINCE 1846 • CINCINNATI 22, OHIO

They Say—

Equal time for Tower

Dear Sir:

I must take exception to your article "Even a Winner May Not Pay Off" (OGJ, Sept. 19, p. 76).

Lyndon Johnson is running for reelection to the United States Senate as well as for vice president. Several suits have been filed in court which proclaim his dual candidacy as being unconstitutional. Even if the courts allow him to run for both offices, he is opposed by capable Republican opponents.

You acknowledge his vice presidential opponent but you failed to mention, or even imply the existence of, his senatorial opponent. For your information, he is opposed by the very capable John G. Tower of Wichita Falls for United States Senator.

Tower has taken a very strong stand in favor of the depletion allowance. Texas oil men need not fear for the depletion allowance if they put their votes, their efforts, their influence, and their money behind both Richard Nixon and John Tower.

Karl A. Riggs
Consultant
Dallas

Accent the positive

"Politics is the foundation for our nation's free economic system and you cannot protect the economic system without paying close attention to the operations of our political system.

"This seems fundamental, but until very recently business paid little or no attention to it. And if business has, in general, been respected and protected, this is due, I think, more to the inherent strength of our political system than to any efforts on the part of business leaders.

"I think that as far as politics is concerned, two things may be said about the business effort, such as it is. First, it generally has been against things, and then only when immediate interests were threatened; second, it has by and large resulted only in business carrying on a commiserating conversation with itself.

"Gulf's political program . . . is a positive program, based, first, on the solid premise that what is good for the community is good for the company, and, it is for things, and not merely against them."

Henry La Cossitt, public relations

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representative, Gulf Oil Corp., in a speech to the New Mexico Petroleum Industries Committee.

Takes money to make it

"To pay one stockholder a dividend of $1, the average company must make a net profit of $2 (half the net is plowed back to replace equipment or for expansion).

"To make a net profit of $2, that company must earn $4.16 before taxes (corporate taxes are generally 52%).

"To earn $4.16 before taxes, the company must sell $68 worth of goods or services (the all-industry profit average is about 3% of sales).

"To create one new job in industry, the company, it has been estimated, must find $16,000 in net new investment—either from profits or from borrowing that ultimately must be repaid from profits. (This is the average cost of tools, training, plant, overhead, etc., behind each American worker.)

"To have available $16,000 out of profits to create a new job, the company must do $528,000 worth of business."

Editorial in Panhandle Lines, magazine of Panhandle Eastern Pipe Line Co.

Frills may have to go

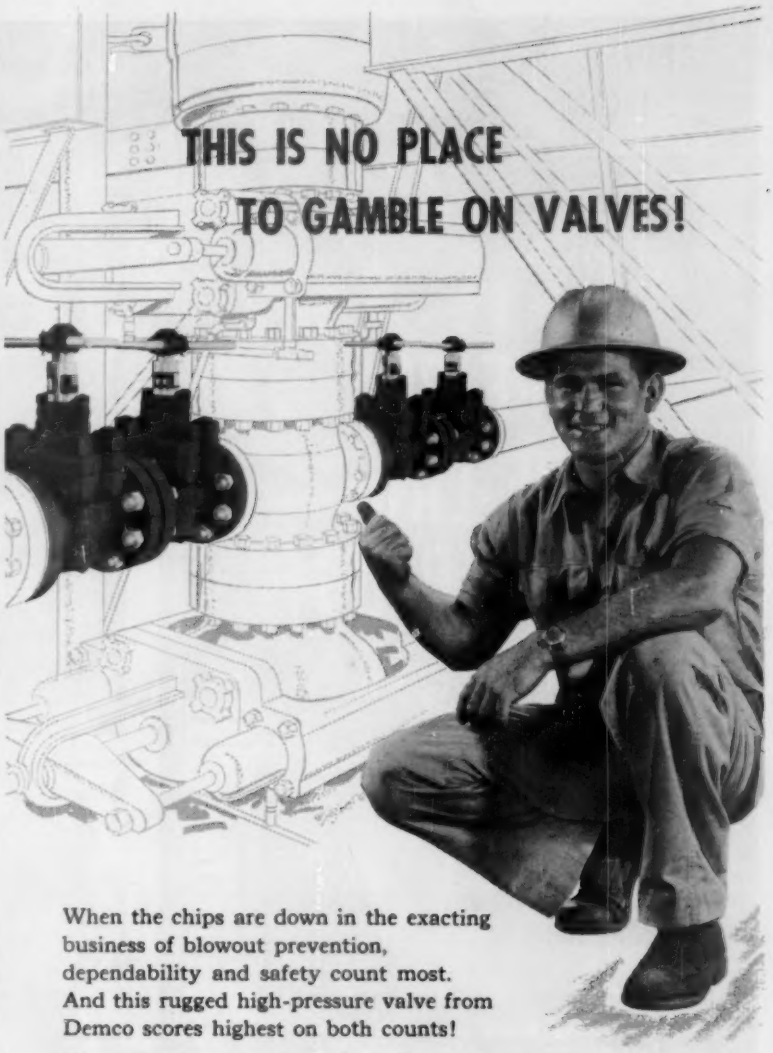
"For some reason we seem to be quite conscious of federal taxes and federal spending but relatively unconscious of state and local spending.

"Yet, state and local governments are spending about $47 billion a year, and that is equal to about half of the federal budget. It is greater than either the defense or the federal budget for all domestic purposes.

"The problem is two-pronged. On the one hand, we are now taxing in total very close to the percentage of our gross national production that can be taken for governmental purposes without the economy beginning to fall apart. Thus, there is a serious question as to whether we can safely raise more tax dollars, and, even if so, where they can be raised.

"The only potential source of substantial further revenue lies in those families earning less than the national average, and such taxes are, of course, not popular, politically or otherwise.

"The other aspect of the problem is that on the whole we are probably not spending as much at the state and local level as we really should. Educational and other important services are being stifled. The rapidly growing metropolitan areas are becoming desperate and a number of our states are in extremely poor financial help.



When the chips are down in the exacting business of blowout prevention, dependability and safety count most. And this rugged high-pressure valve from Demco scores highest on both counts!

The rugged construction of the Demco Valve assures its reliability—it *holds every time* against the high pressures of an unexpected flow. You get a positive rubber-to-metal seal without applying undue torque to the stem—a drop-tight seal that you can depend on.

And no matter when you need it, the Demco valve will always operate easier. Fewer parts are subject to wear. Stem threads are constantly self-lubricated and are protected from abrasives with *double* stem seal.

When you choose a valve for blowout prevention application, choose reliability, rugged construction and sure-seal safety. Choose Demco!

Available at supply stores everywhere in 1,000, 2,000, 3,000 and 5,000 psi working pressures . . . in two- to four-inch sizes.

DRILLING EQUIPMENT MANUFACTURING CO.

845 S. E. 29th Street • OKLAHOMA CITY

DEMCO

NEW FROM OTIS

TYPE BC WIRE LINE BRIDGE PLUG

- Short, compact—less to drill up.
- Small O. D. for easy running.
- Covers wider range of casing weights.
- Can be set with any pressure setting tool.

Here's a casing bridge plug with more plus features than any other plug on the market—yet it costs you no more! It's short and compact—less to drill up—designed to save you up to 50 per cent in rig time when the plug is removed. The Type BC Otis Wire Line Bridge Plug is designed to provide a positive plug, to prevent movement of fluid or gas from either direction in the casing, or to plug and abandon. The Type BC has a small O.D. for ease of running—yet it is designed to set in a wider range of casing weights than any other plug available today.

AVAILABLE THROUGH ANY ELECTRIC LINE SERVICE COMPANY. The Type BC Otis Wire Line Bridge Plug is available through any electric line service company and may be set with any pressure setting tool. Otis bridge plugs are stocked at more than 247 different field locations to make sure they are readily available to the service company of your choice. The next time you need a bridge plug — specify Otis.

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General Offices: 6612 Denton Drive, Dallas
Branches Throughout the Oil Country

"This means that political leaders at all levels of government—and particularly the new administration in Washington—are going to have to face facts in a way they have not been accustomed to facing them. If we are to find our way out of this situation, there must be sharp lines drawn between that which is essential, productive, or economic and that which is merely convenient or nice for certain groups."

Dr. Leland I. Doan, president, Dow Chemical Co., in a speech to company stockholders.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR OF EVENTS

OCTOBER

4-5 University of Kansas, gas-measurement institute, National Guard Armory, Liberal, Kans.

5 Society of Plastics Engineers, Inc., regional technical conference, Mark Hopkins Hotel, San Francisco.

5-7 Four Corner Geological Society, third field conference, geology of the central Paradox basin, registration Oct. 4, Moab, Utah.

6-7 National Association of Corrosion Engineers, annual western region conference, Sheraton-Palace Hotel, San Francisco.

6-8 National Association of Corrosion Engineers, southeast region conference, Dinkler-Plaza Hotel, Atlanta, Ga.

6-8 National Academy of Sciences, National Research Council, ninth national clay conference, Purdue University, Lafayette, Ind.

10-12 American Gas Association, annual convention, Atlantic City.

11-14 National Association of Corrosion Engineers, northeast region conference, Prichard Hotel, Huntington, W. Va.

12-14 Southwestern Federation of Geological Societies, annual meeting, Wooten Hotel, Abilene, Tex.

13-14 California Natural Gasoline Association, annual fall meeting, Hotel Miramar, Santa Monica, Calif.

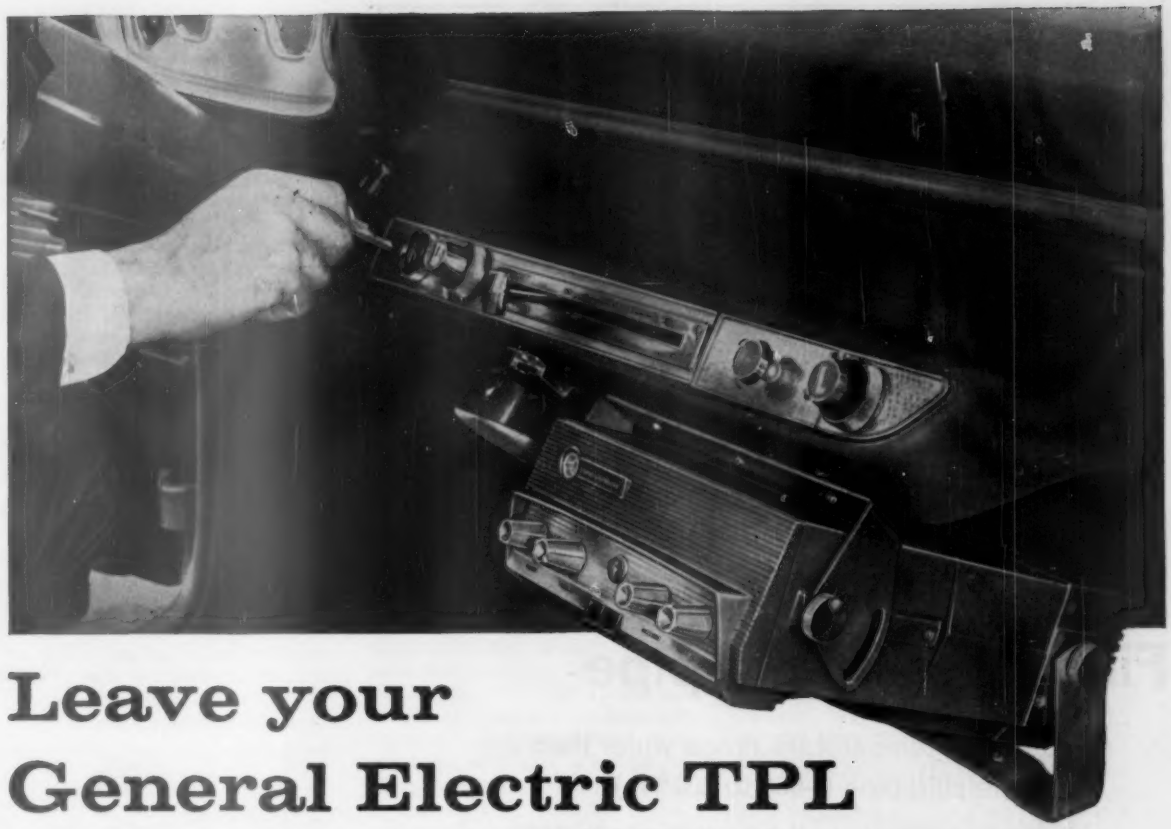
13-15 Southwestern Legal Foundation, American Association of Petroleum Landmen, second national institute for petroleum landmen, Dallas.

13-16 Taft, Calif., Oildorado, fiftieth anniversary celebration.

14-15 University of Texas, E. P. Schoch lecture series on rate processes, Batts Hall Auditorium, Austin.

14-16 New Mexico Geological Society, annual field conference, Chama basin of northern New Mexico, registration, Taos, Oct. 13.

17-19 American Society of Mechanical Engineers, American Society of Lubri-



Leave your General Electric TPL 2-way radio on while your engine is off!

LOWEST BATTERY DRAIN AVAILABLE

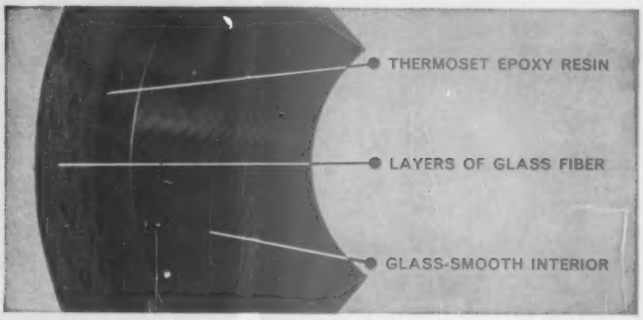
Other makes of mobile radio drain your battery severely, even on standby. Unless you keep the engine running, this will inevitably shorten the life of your battery. And if you *do* run the engine while your vehicle is standing still, you're letting yourself in for a whole series of other problems—increased gas consumption, increased engine wear, special generators, etc.

Not so with TPL! Standby battery drain on General Electric's new Transistorized Progress Line is so low you need never turn off the TPL unit in your vehicle. By actual measurement, drain is less than 40 milliamperes, or only 1/25 of the current that runs your dome light. And even when the receiver is talking, drain is only 540 milliamperes.

With only four tubes in the TPL transmitter, you require no special generator, use less gas and need fewer engine jobs. The cost of operating your two-way radio system goes way, way down.

Get the full story on TPL—the smallest, most reliable two-way radio you can buy today. Write General Electric Company, Communication Products Dept., Sec. 18100-3, Mountain View Road, Lynchburg, Virginia.

GENERAL ELECTRIC



EPOXY RESIN AND GLASS FIBERS combined in a high-speed centrifugal casting operation. High quality components processed under rigid quality controls bring to industry a unique and efficient non-metallic pipe.

"Impossible" corrosion, temperature and pressure problems solved by Fibercast® epoxy pipe

- Operating temperature range wider than any non-metallic pipe (–65° to 300° F.)
- Operating pressure range extends to 1000 psi.
- Effectively combats corrosion, contamination, abrasion, scaling, electrolytic action.

Fibercast Tubing (right) used to suspend a 1,200 lb. pump for 3 years in a salt water supply well. *There was no loss in strength.* The damaged plastic-coated steel nipple (left) was used in the same installation, failed after 3 months' service.

WHAT is Fibercast?

It is a centrifugally cast, thermoset, epoxy resin reinforced pipe that handles temperature and pressure problems where no other non-metallic pipe will do.

Its body of woven glass fibers provides resistance to high tension forces. These fibers, combined by adhesion, are imbedded and bonded by heat in epoxy resin. The result is a strong, long-lasting pipe with remarkable ability to withstand high pressure and temperature in corrosive environments.

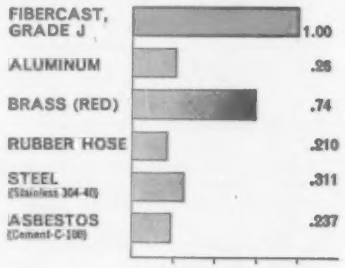
WHY use Fibercast?

For a multitude of reasons. Because its advantages range from superior resistance to heat, pressure and corrosion, to its ease of handling, light weight, dielectric properties and structural stability. Because Fibercast's long service life alone would justify choosing it over other materials. Because even more expensive metal pipe or pipe with thermo-plastic interior coatings cannot match Fibercast's proven durability. Case histories and accurate testing have proved over and over that Fibercast performs better, lasts longer, costs less. Out of 338 common corrosive solutions, Fibercast competently handles 320. And naturally, Fibercast's unique and lasting qualities under such conditions mean that it drastically reduces maintenance and replacement costs, too.

Although Fibercast's light weight makes it correspondingly easy to work with (it is less than 25% the weight of steel), it has the same basic linear coefficient of expansion as steel (7.06 x 10^{-6} to 8.25 x 10^{-6} in./in./°F.). Fibercast's strength permits installation on pipe racks with span lengths generally used for metal pipe.

The pipe has a smooth interior, with a Hazen-Williams C Flow Factor of 147. This cuts friction losses, aids flow and tends to resist build-up. It is a non-conductor (accepted by the electrical industry as a superior insulator), and is not subject to cold flow. A low coefficient of heat transfer (3.0 x 10-3 Cal/CM²/sec/CM°C.),

COMPARATIVE LIFE DATA*



*Basing Fibercast as unit life of 1 and others as comparative percentages thereof.

minimizes heat loss and may even eliminate heat tracing.

All three major systems of joining all pipe are used with equal success on Fibercast. They are: standard flanged, cemented, and threaded and coupled with a complete selection of Fibercast fittings (the world's largest line of corrosion-resistant epoxy pipe fittings).

Safety, too, is an important reason for using Fibercast Pipe in transporting dangerous chemicals, particularly in areas where the pipe is adjacent to personnel. Most piping materials corrode undetectably from inside-to-out and can suddenly burst without warning, inflicting injury to personnel. Because of Fibercast's woven glass fiber construction, such occurrences, if they ever occur, *are* detectable in minute, repairable leaks.

WHO uses Fibercast?

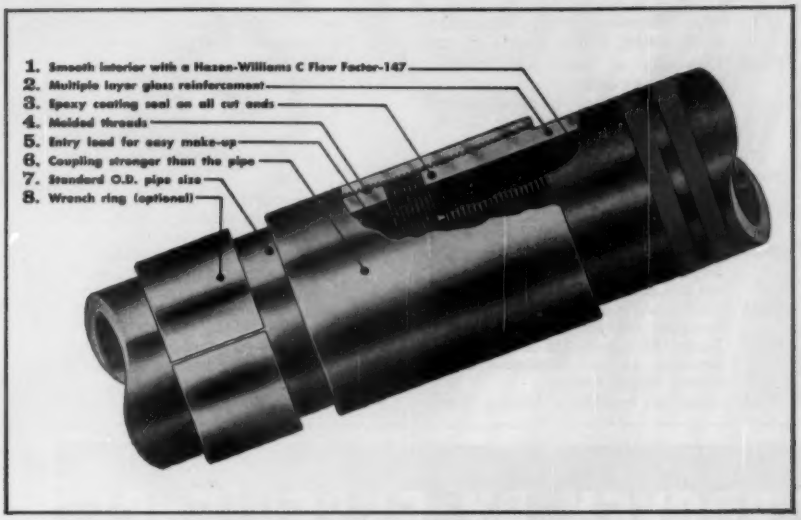
The petroleum industry . . . chemical . . . petro-chemical . . . nuclear energy . . . textile . . . paper . . . and food-processing industries . . . countless operations handling acids, alkalies, salt water and other corrosive liquids under pressure can all use Fibercast profitably.

In oil country, Fibercast is already

Workman is painting a section of Fibercast Pipe bearing 32% HCl at Shell's Texas Chemical plant. Note that Fibercast has sufficient strength for installation on span racks with the spacing normally used for metal pipes.

widely acclaimed for superior performance in rugged, abusive and even high pressure installations like salt water disposal wells and horizontal lines. In cases where other pipe and tubing required replacement after just a few weeks of service, Fibercast is still performing efficiently after many years.

In petro-chemical and chemical-processing plants, Fibercast is valued


1. Smooth interior with a Hazen-Williams C Flow Factor-147
2. Multiple layer glass reinforcement
3. Epoxy coating seal on all cut ends
4. Molded threads
5. Entry lead for easy make-up
6. Coupling stronger than the pipe
7. Standard O.D. pipe size
8. Wrench ring (optional)

8 Points of Fibercast Superiority

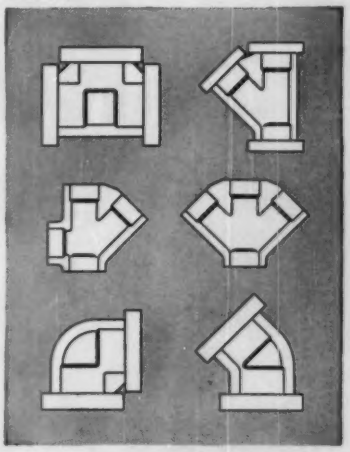
not only for high heat and corrosion resistance, but also for its remarkable maintenance of the purity of the solutions it is required to carry. Such installations range from Fibercast pipes which carry 37% hydrochloric acid at ambient temperatures to lines carrying solutions containing brine, alum, and other sulphates, sulphuric and phosphoric acids, and other damaging chemicals.

Food-processing industries, among the most demanding of all industries in purity, corrosion and heat standards of operation, know the long-term benefits of using Fibercast. Fibercast is especially effective in the processing of foods requiring use of sulphuric and phosphoric acids (such as corn syrup, starches, gelatins), as well as brines and other highly corrosive acids and solutions.

The operating conditions peculiar to the man-made textile and paper processing plants are also improved by the use of Fibercast Pipe and Fittings. The ever-growing demands of all industry . . . the rigid quality controls imposed by governmental and other agencies . . . the unique and often unsolved needs of new processes and methods . . . all of these factors help to create "impossible" problems that can be solved by the use of Fibercast.

Complete Line of Fittings

Fibercast provides fittings to solve any fitting problem. Besides a vast stock of standard sizes and types, Fibercast also designs and makes special fittings to meet individual requirements. All, of course, have the same corrosion, pressure and heat resistance properties of Fibercast Pipe and Tubing. A few of the regularly stocked types are shown in the line drawings below.



If *you* have an "impossible" corrosion, temperature, or pressure problem, consider the advantages of using Fibercast. To receive a free sample of Fibercast, and to get specific information about how Fibercast can help *you*, mail the coupon below.

FIBERCAST COMPANY
BOX 727, Sand Springs, Oklahoma

Please send me further information about Fibercast Tube and Pipe. OGJ-10A

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Firm_____

Type of Business_____

Address_____

City_____ State_____

FIBERCAST COMPANY — A DIVISION OF Youngstown SHEET AND TUBE COMPANY

cation Engineers, lubrication conference, Statler Hilton Hotel, Boston.

17-19 University of Minnesota, Pennsylvania State University, Colorado School of Mines, biannual symposium on drilling and blasting, Golden, Colo.

17-Nov. 5 University of Oklahoma, School of Petroleum Engineering, short course in advanced drilling practices for engineers, University of Oklahoma, Norman.

19-20 National Association of Corrosion Engineers, north central region conference, Schroeder Hotel, Milwaukee.

19-21 Gulf Coast Association of Geological Societies, convention, Biloxi, Miss.

19-21 Rocky Mountain Oil and Gas Association, annual convention, Brown Palace Hotel, Denver.

20-21 American Institute of Mining, Metallurgical, and Petroleum Engineers, Los Angeles Basin, fall meeting, Huntington Sheraton Hotel, Pasadena, Calif.

20-23 Permian Basin Oil Show, Odessa, Tex.

21 Southern Gas Association, roundtable conference on pipeline operations and maintenance, Lamar Hotel, Houston.

23-25 Independent Petroleum Association of America, annual meeting, Statler-Hilton Hotel, Dallas.

24-25 American Society of Mechanical Engineers, American Institute of Electrical Engineers, fuels conference, Daniel Boone Hotel, Charleston, W. Va.

25-28 National Association of Corrosion Engineers, south central region conference, Mayo Hotel, Tulsa.

26-27 Armour Research Foundation of Illinois Institute of Technology, computer applications symposium, Morrison Hotel, Chicago.

26-27 Western Petroleum Refiners Association, annual question and answer session on refining technology, Rufus Garrett Hotel, El Dorado, Ark.

28 Natural Gasoline Association of America, southern regional meeting, Carlton Hotel, Tyler, Tex.

28 American Institute of Chemical Engineers, South Texas section annual technical meeting, Rice Hotel, Houston.

31-Nov. 4 University of Oklahoma, petroleum landmen's institute, Student Union Building, University of Oklahoma, Norman.

NOVEMBER

3 West Central Texas Oil and Gas Association, annual meeting, Hotel Windsor, Abilene, Tex.

3-4 American Association of Petroleum Geologists, Pacific section, annual meeting, Ambassador Hotel, Los Angeles.

3-4 Society of Automotive Engineers, national fuels and lubricants meeting, Mayo Hotel, Tulsa.

6-9 Chemical Institute of Canada, chemical engineering division, conference, Quebec City.

7-10 Society of Exploration Geophysicists, international meeting, Moody Convention Center, Galveston, Tex.

14-16 American Petroleum Institute, fortieth annual meeting, Conrad Hilton, Palmer House and Congress hotels, Chicago.

14-16 Society of Petroleum Engineers of AIME, Venezuelan sections, fourth annual meeting, Maracaibo, Venezuela.

15-16 University of Kansas, natural-gas pipeline institute, Courthouse, Liberal, Kans.

15-17 Southwest Research Institute, Air Force, Navy, industry propulsion systems lubricants conference, Hilton Hotel, San Antonio, Tex.

18 Natural Gasoline Association of America, Panhandle Plains regional meeting, Herring Hotel, Amarillo, Tex.

22 Manufacturing Chemists' Association, tenth semiannual meeting and midyear conference, Statler Hilton Hotel, New York City.

27-Dec. 2 American Society of Mechanical Engineers, winter annual meeting, Statler Hilton Hotel, New York.

DECEMBER

4-7 American Institute of Chemical Engineers, meeting, Statler Hotel, Washington.

5-7 Interstate Oil Compact Commission, annual meeting, Westward Ho Hotel, Phoenix.

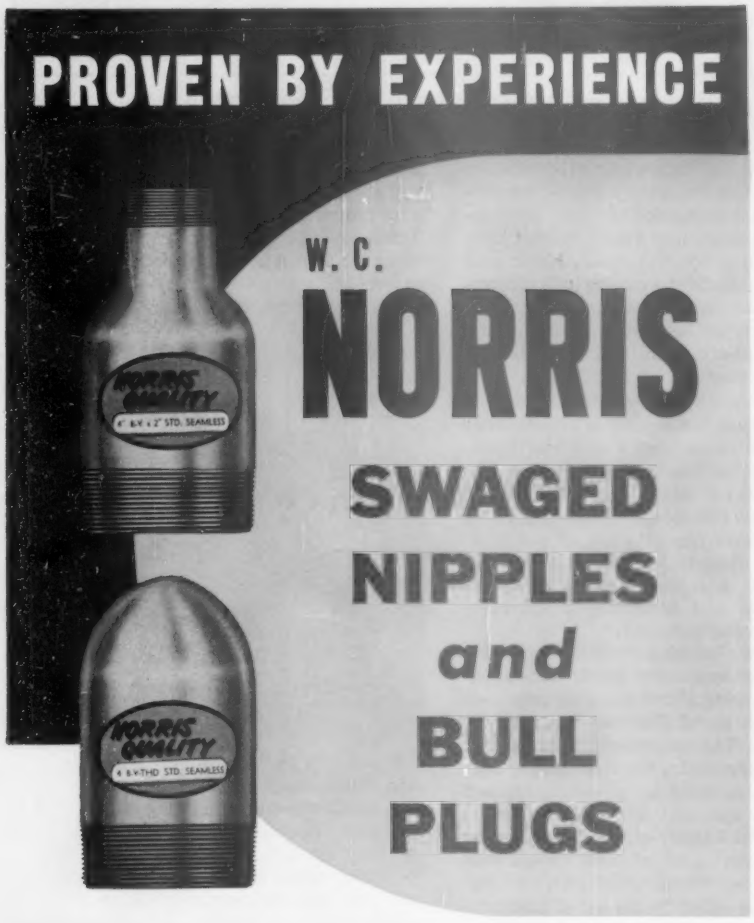
9 Tulane University, School of Law, and American Association of Oilwell Drilling Contractors, fifth annual program on mineral and tidelands law, University Center, Tulane University, New Orleans.

26-31 American Association for the Advancement of Science, annual meeting, New York City.

JANUARY

15-18 Pipe Line Contractors Association, annual meeting, Mark Hopkins and Fairmont Hotels, San Francisco.

16-19 Instrument Society of America, win-



Safety . . . craftsmanship . . . durability . . . precision . . . yes, these elements are important in Swaged Nipples and Bull Plugs. And, these are the elements found in *all* W. C. Norris fittings — elements proven by the experience of our customers.

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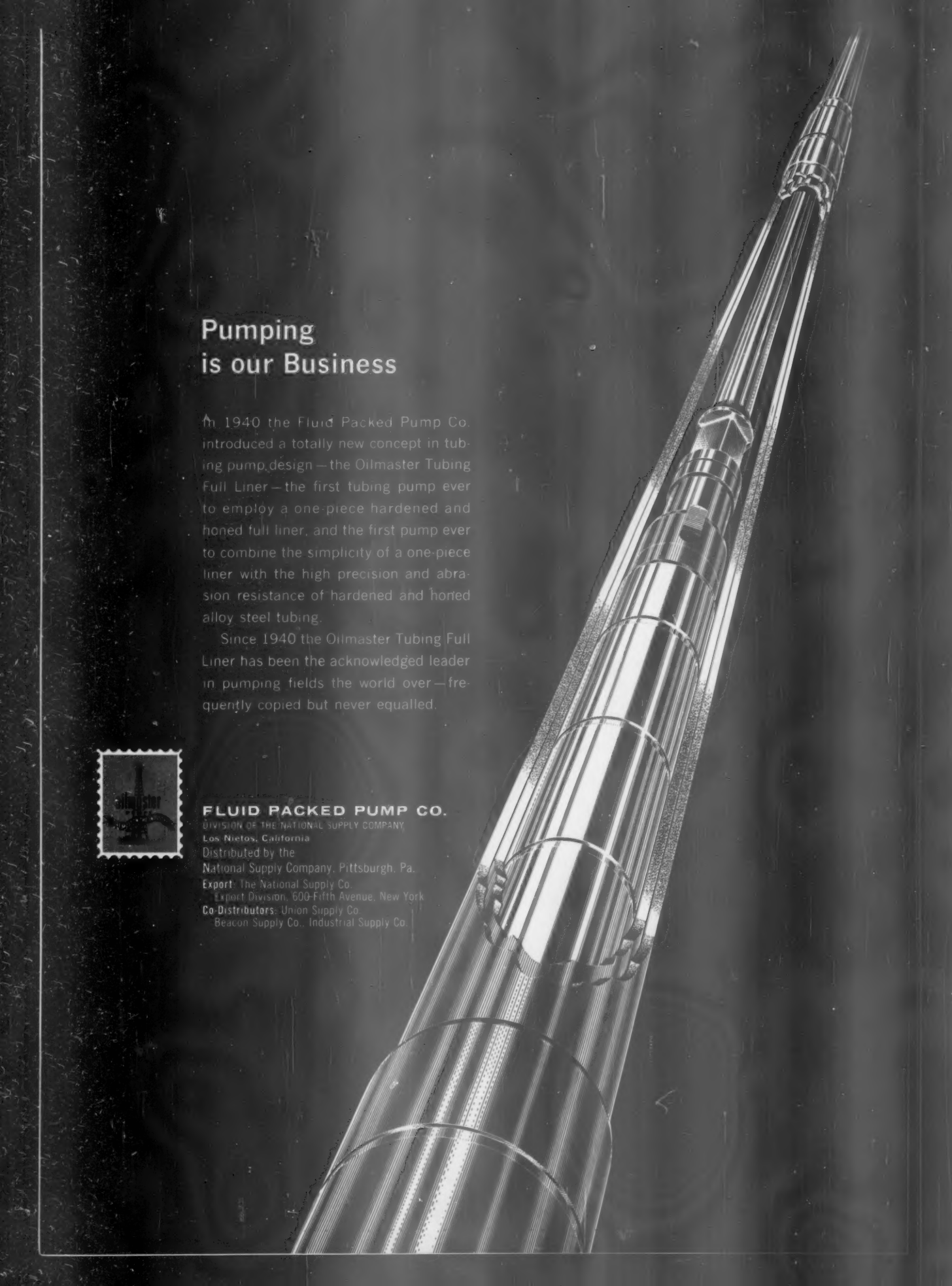
stam·i·na vigor; capacity for enduring
WEBSTER

The exceptional stamina of the Oilmaster Subsurface Hydraulic Production Unit is not a result of chance. From swab nose to hold-down this unit is designed with a capacity for enduring. In installations under a packer, in high gas oil ratio wells, and in wells where the fluid produced is abrasive, the Oilmaster Hydraulic operates at efficiencies previously believed impossible and with only a minimum of maintenance. Ask your Oilmaster representative about the stamina of this versatile unit. Have him tell you about the Flood Valve—how it eliminates fluid pound and lubricates the wear parts of the pump, or write for Bulletin E5903.



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In 1940 the Fluid Packed Pump Co. introduced a totally new concept in tubing pump design—the Oilmaster Tubing Full Liner—the first tubing pump ever to employ a one-piece hardened and honed full liner, and the first pump ever to combine the simplicity of a one-piece liner with the high precision and abrasion resistance of hardened and honed alloy steel tubing.

Since 1940 the Oilmaster Tubing Full Liner has been the acknowledged leader in pumping fields the world over—frequently copied but never equalled.

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Export Division, 600 Fifth Avenue, New York
Co-Distributors: Union Supply Co.
Beacon Supply Co., Industrial Supply Co.

ter instrument-automation conference and exhibit, Sheraton-Jefferson Hotel and Kiel Auditorium, St. Louis.

17-19 Kentucky Petroleum Marketers Association, annual meeting and convention, Brown Hotel, Louisville.

20 Natural Gasoline Association of America, Gulf Coast regional meeting, Robert Driscoll Hotel, Corpus Christi, Tex.

FEBRUARY

7-8 University of Oklahoma, School of Petroleum Engineering, advanced petroleum engineer seminar, University of Oklahoma, Norman.

24 Natural Gasoline Association of America, South Louisiana regional meeting, Lafayette Petroleum Club, Lafayette, La.

26-Mar. 1 American Institute of Chemical Engineers, petrochemical and refining exposition, Municipal Auditorium, New Orleans.

26-Mar. 2 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, Chase and Park Plaza Hotels, St. Louis.

MARCH

7-8 University of Oklahoma, School of Geological Engineering, seventh biennial geological symposium, Student Union Building, University of Oklahoma, Norman.

8-10 American Petroleum Institute, Division of Production, southern district meeting, Captain Shreve and Washington-Youree hotels, Shreveport, La.

13-17 National Association of Corrosion Engineers, annual meeting and corrosion show, Hotel Statler, Buffalo, N. Y.

15-17 Natural Gasoline Association of America, annual convention, Baker Hotel, Dallas.

22-24 American Petroleum Institute, Division of Production, southwestern district meeting, Cole Hotel, Albuquerque.

23 National Industrial Conference Board, general session, Shamrock-Hilton Hotel, Houston.

27-29 Midwest Gas Association, annual meeting and convention, Sheraton-Fontenelle Hotel, Omaha.

28-29 University of Oklahoma, Schools of Petroleum and Gas Engineering, gas conditioning short course, Oklahoma Memorial Union Building, University of Oklahoma, Norman.

APRIL

5-7 American Petroleum Institute, Division of Production, Mid-Continent district meeting, Mayo Hotel, Tulsa.

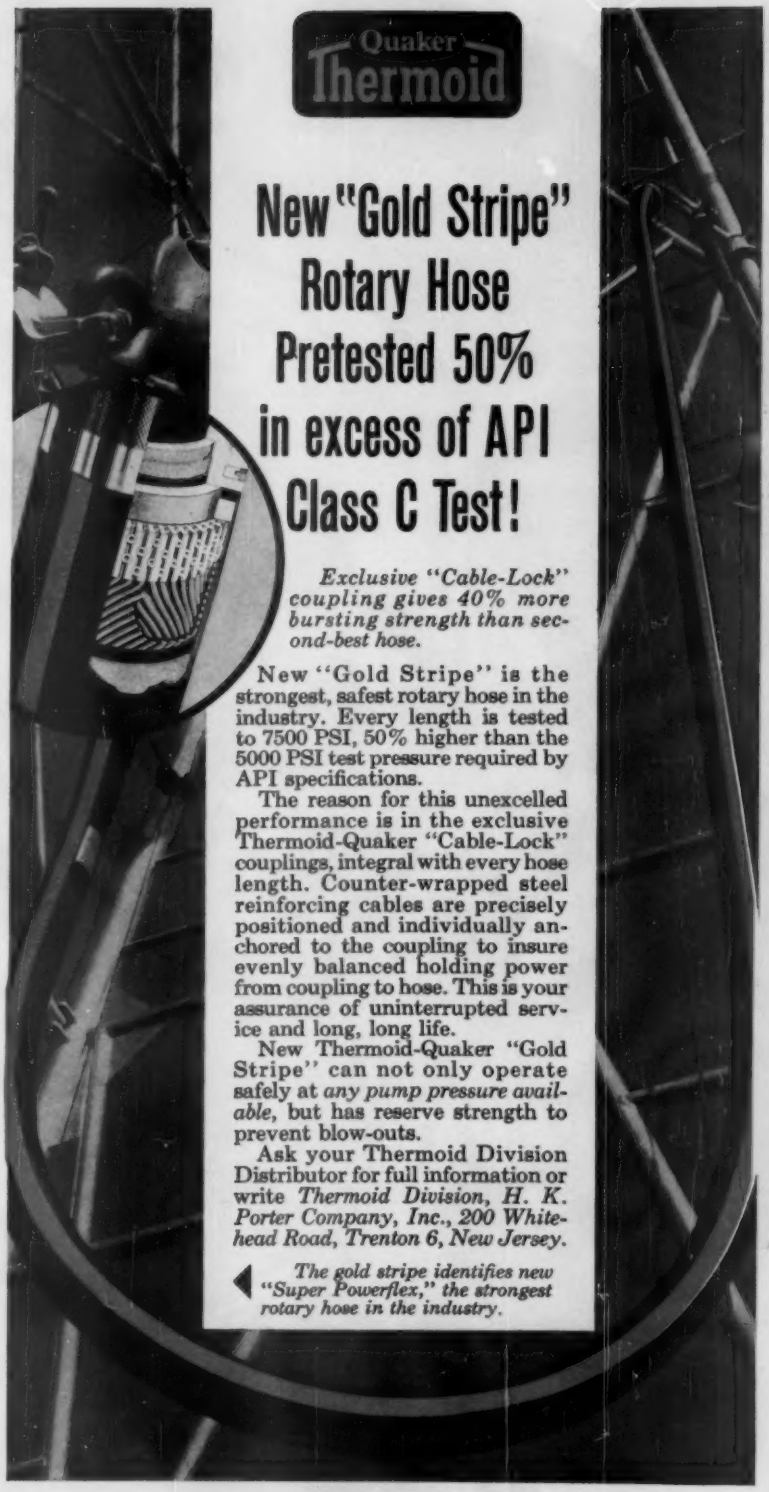
20-21 Society of Petroleum Engineers of AIME, East Texas-Louisiana-Arkansas gas-technology symposium, Tyler, Tex.

24-26 Southern Gas Association, meeting, New Orleans.

24-27 American Association of Petroleum Geologists, Society of Economic Paleontologists, and Rocky Mountain section of AAPG, annual meeting, Denver Hilton Hotel, Denver.

26-28 American Petroleum Institute, Division of Transportation, pipeline conference, Chase-Park Plaza Hotel, St. Louis.

28 Natural Gasoline Association of America, Oklahoma regional meeting, Lake Murray Lodge, Ardmore, Okla.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New "Gold Stripe" Rotary Hose Pretested 50% in excess of API Class C Test!
Exclusive "Cable-Lock" coupling gives 40% more bursting strength than second-best hose.
New "Gold Stripe" is the strongest, safest rotary hose in the industry. Every length is tested to 7500 PSI, 50% higher than the 5000 PSI test pressure required by API specifications.
The reason for this unexcelled performance is in the exclusive Thermoid-Quaker "Cable-Lock" couplings, integral with every hose length. Counter-wrapped steel reinforcing cables are precisely positioned and individually anchored to the coupling to insure evenly balanced holding power from coupling to hose. This is your assurance of uninterrupted service and long, long life.
New Thermoid-Quaker "Gold Stripe" can not only operate safely at any pump pressure available, but has reserve strength to prevent blow-outs.
Ask your Thermoid Division Distributor for full information or write Thermoid Division, H. K. Porter Company, Inc., 200 Whitehead Road, Trenton 6, New Jersey.
The gold stripe identifies new "Super Powerflex," the strongest rotary hose in the industry.
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PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

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JOURNALLY SPEAKING

50 years ago

October 6, 1910

Reports that Lake Shore Oil Co. has discovered oil in the isolated Lost Hills area in northwestern Kern County, 30 miles from Bakersfield, Calif., starts a wild rush of persons to locate land or protect claims from "jumpers". At Wasco, nearest settlement, 20 miles distant, every available team, buggy, or saddle horse has been hired.

American Vacuum Oil Co. is establishing agencies in Morocco to introduce the use of petroleum to be brought in from the company's depot at Lisbon, or imported from Austria-Hungary. Main use of petroleum is expected to be for lamps to replace candles, of British manufacture, and now widely used by natives. Petroleum is expected to be a cheaper and more powerful illuminant.

25 years ago

October 3, 1935

Oxford pool, in Sumner County, Kansas, where the largest wells in the state's oil history recently have been completed, adds a 15,600-bbl. well to its gusher list. Another new well is extending the pool into the townsite, where an intensive drilling play is expected. Latest gusher is Amerada Petroleum Corp.'s 13-A Gassaway, productive from Simpson Dolomite at 2,800 ft.

Michigan oil production passes 50,000,000-bbl. mark with end of first decade since first commercial field was discovered at Saginaw, in 1925. Daily output during week climbs 49,566 bbl., a new all-time record. Porter-Yost area of Midland County holds lead with 24,777 bbl. daily. Crystal field, in Montcalm County, narrows margin with daily flow of 17,478 bbl.

10 years ago

October 5, 1950

U. S. Department of the Interior takes over control of California tidelands oil fields under the revised stipulation recently agreed to by the federal and state governments. State to turn over to federal Government all rentals, royalties, and other receipts from leases.

Experts tell gas industry future recoverable natural gas in the United States will exceed 500 trillion cubic feet. Yearly withdrawals expected to increase from current 6.25 trillion cubic feet to 10 trillion cubic feet by 1960.

Pure Oil Co. opens for public inspection newly completed centralized and expanded research and development department laboratories on 140-acre campus at Crystal Lake, 45 miles from Chicago.

Chicken Little committee

WE WHO live by putting words down on paper are often the subject of envy on the part of certain friends. "What an easy way to make a living," they say. "All you have to do is write a little old column once a week."

Well, on the surface it does look easy. But writing that little old column is just one of many duties which accrue to a job at the Journal.

We also make speeches.

And therein lies a special hazard. The hazard is that people listen to these speeches. And a greater hazard is that sometimes other reporters are in the audience taking notes.

Now these other reporters have the same problems we have, and we respect them greatly. Their biggest bugaboo (and ours) is the gremlin who trips up and down the keyboard of the linotype machine. One figure out of place and your story is ruined.

The hazard involved in a simple error was beautifully demonstrated on the editorial page of a Tulsa newspaper a couple of weeks ago.

This reporter made a speech (first mistake). Another reporter was in the audience (second mistake). He took notes (third mistake), and filed a story with his paper (fourth mistake). The typesetter composed the story on his linotype machine (fifth mistake). And this reporter was misquoted in public print (horrible mistake).

It wasn't too bad at first. In the course of the speech, the statement was made that conceivably the world could run out of oil in 425 years if that world were one big empty tank, completely filled with oil, and if world demand continued to increase 6% per year as it is doing now.

Well, the news report said that Gardner said that we'd be out of oil in 40 years.

Nobody blinked. Nobody said a word. The Journalites knew that a mistake had been made, and we knew that any thinking oil man would also recognize the mistake. We relaxed.

Suddenly—boom! An alert editorial writer at the newspaper seized upon the item. A Journal editor says we are running out of oil. Now, Mr. Kennedy . . . now, Mr. Nixon . . . what are we going to do? Where do you stand on this matter of depletion?

Whoom! The telephone began to ring. The letters began to come in. Chicken Little was a piker—she only said the sky was falling down. Is Gardner out of his mind?

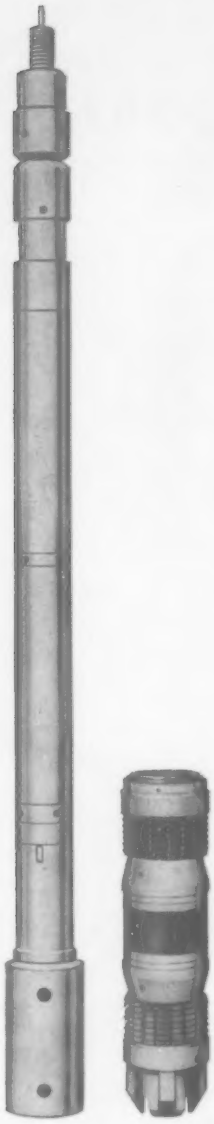
No. For the first time in his life, this reporter wrote a letter to an editor. But before it reached said editor, a small correction appeared in a later edition of the newspaper. It was very nice, but it, too, ended with a typographical error.

Next day—another editorial, explaining the first one. And the head was terrific—NOT 40, NOT 425, BUT ALWAYS. This time everything was straight. The speaker was quoted correctly, the newspaper was exonerated, and everyone went home feeling fine.

Or did they? The whole thing had been a little disturbing. This reporter had a dream that night. Nixon read the editorial. So did Kennedy. A congressional committee was appointed to investigate—the Chicken Little Committee, they called it, under the chairmanship of Senator Gremlin. Gardner was called to testify . . . were we actually to run out of oil in 40 years, or was Gardner just chicken? Gardner invoked the 425th amendment and the committee sent him flying into space to look for oil on other planets. As he entered the space capsule, it misfired, and Gardner fell on the floor of his bedroom.

Easy way to make a living? There's more to it than writing a little old column every week.

—Frank J. Gardner



Baker Wire Line Pressure Setting Assembly, Product 437

Baker Wire Line Bridge Plug, Product 400-N

RUNNING MATES

A Baker Bridge Plug is tough and reliable. So is a Baker Wire Line Pressure Setting Assembly. They're running mates—a matched pair. They've been working together for years, building a reputation for dependability.

The average wells or the hot, high pressure wells—a Baker Bridge Plug masters them all. Whether you measure its life span in hours or in years, it's got what it takes to do its job.

Setting a plug on wire line today is a simple operation, and a fast and sure one. What makes that possible is the Baker wire line setting tool. A good setting tool is as important as a good plug.

Like the bridge plug itself, the setting tool is a Baker innovation. A Baker plug and Baker setting tool work well together because they were designed to do just that.

Leading wire line service companies set Baker Wire Line Bridge Plugs accurately and promptly using the Baker Wire Line Pressure Setting Assembly.

Other models of Baker Bridge Plugs can be set on tubing or drill pipe. They are all made in drillable, corrosion-resistant cast iron for permanent service, and in fast-drilling magnesium for temporary service.

BAKER WIRE LINE BRIDGE PLUGS

BAKER OIL TOOLS, INC. / HOUSTON / LOS ANGELES / NEW YORK

BAKER

FPC applies common sense to gas regulation

IT WILL TAKE TIME to analyze thoroughly and to evaluate accurately all facets of the FPC's Phillips case decision and its accompanying statement of policy (p. 56).

But it is immediately clear that the commission has taken a long, important step toward a common-sense approach.

No one can deny the pressing need for a practical, workable plan aimed at bringing some semblance of order out of the present state of regulatory chaos. And that is what the commission is now seeking to provide.

The commission is unquestionably right in abandoning the case-by-case, rate-base procedure. As the commission so aptly concludes, that approach simply will not work.

It is right in saying flatly that the utility concept of control, using detailed cost accounting, can not be applied to each individual producer. It can not, that is, if the agency is ever going to be able to dispose of the huge backlog of cases that has so completely clogged its regulatory machinery.

Perhaps most important of all is the reasoning by the commission that its prime duty is to insure consumers of an adequate supply of natural gas at prices that are no higher than necessary.

That must make common sense to everyone, even to the most rabid consumer "protectionist."

OF COURSE it remains to be seen how successful the commission can be in determining what, precisely, constitutes a fair price.

It is starting out to try to do so by using the area-pricing approach. That is, it will use cost data from representative producers in an area, together with economic data and other information at its disposal, to set price levels for that area.

This is sure to bring protests—legitimate protests—from any producers hurt by the price levels applicable to them. The commission realizes this.

However, the commission makes it abundantly clear that its schedule of area prices is for guidance only and does not prevent any producer from justifying a different rate—or trying to do so.

And the commissioners readily concede that over-all revisions and refinements will no doubt be necessary from time to time. These could include changes in area boundaries, provisions for variations in qualities of gas, terms of delivery, and other factors.

THEREFORE, there will be flexibility in the area-pricing procedure, particularly during the formative stages. This is as it should be.

The producer's problems are not over. Far from it. But the commission has made a big move in the right direction.

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RESOURCES EXCEED $3 BILLION

Jet-Fuel Demand to Soar Again in 1961

• A big over-all rise of 16% is predicted. The key factor in this forecast is commercial needs which are expected to jump 50% as passenger fleets expand. Slower growth is seen for the following years.

D. H. Stormont
Refining Editor

CONTINUED expansion of the world's jet fleets assures another big boost in jet-fuel demand next year.

And since U. S. airlines are taking more than half of the new jets, a substantial gain can be expected in domestic demand.

Based on 9 month figures, domestic demand for jet fuels will average about 381,000 bbl. daily this year. This would represent a gain of 55,000 bbl. over the 1959 average. Almost all the increase is in civilian or kerosine-type fuels.

Near-future outlook . . . Jet fuels have become a significant factor in the total petroleum-demand picture and will become even more so in the next 5 years.

As economists of several large oil companies see the future:

. . . In 1961 over-all domestic demand will increase 16%, or to a daily average of about 434,000 bbl. Commercial demand, almost all of which is for kerosine-type fuels, will require about 140,000 bbl. daily or about 50% more than this year. Military demand will continue at about last year's level.

. . . Beyond 1961 the demand curve will begin to flatten slightly insofar as airline needs are concerned. Increases of about 34,000 and 16,000 bbl. daily, respectively, are forecast for 1962 and 1963. Higher military needs during these years will boost the annual increases to around 35,000 or 40,000 bbl., however.

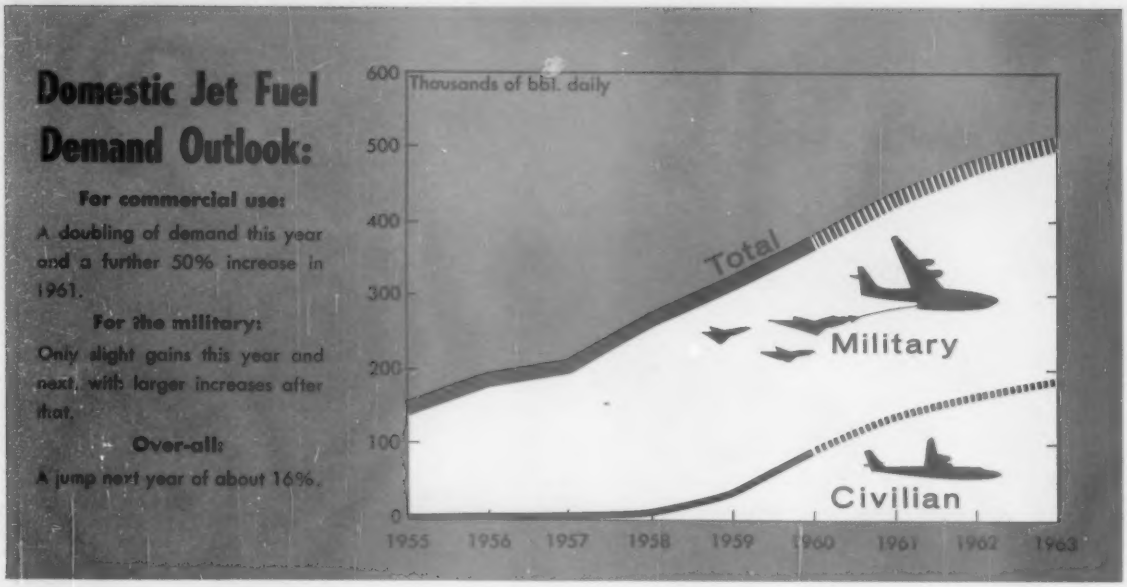
. . . The 500,000-bbl. mark in daily demand may be reached in early 1963. Actually, this demand level could be topped somewhat earlier. It depends upon how much jet fuel the Armed Forces buy overseas.

Total military demand next year is expected to average about 330,000 bbl. daily, and in 1962 and 1963 to be stepped up to more than 340,000 bbl. daily.

During the past 2 years, the military has been securing about 50,000 bbl. of its daily needs from foreign sources, down almost 30,000 bbl. from the 1958 level. If the military continues to buy less fuel abroad and more in this country, the 500,000-bbl. level could be reached in the latter part of 1962.

Bulk of the military demand, of course, is for JP 4 fuel (about 65% gasoline and 35% kerosine). Contrary to the trend anticipated a year or so ago, little change is expected in the demand for JP 5 (kerosine type) fuel. Military consumption this year has averaged about 15,000 bbl. daily. Latest military prediction is for a demand of only some 18,000 bbl. daily during the next 4 years.

A decrease is expected in domestic



demand for aviation gasoline during the next 3 years. The forecast calls for civilian consumption of 66,000 bbl. per day in 1961, 64,000 in 1962, and 62,000 in 1963. A similar downward trend is predicted for military demand—80,000 bbl. per day in 1961, 76,000 the next year, and 74,000 the year after that.

. . . Worldwide jet-fuel demand, exclusive of that in the Iron Curtain countries, will average about 675,000 bbl. daily next year. By 1963 it is expected to grow to 840,000 bbl. daily, with free world foreign consumption accounting for 325,000 bbl. of the total.

Jet-airliner trends . . . Based on jet aircraft ordered by U. S. airlines, next year will see the pure jets catching up with the turboprops.

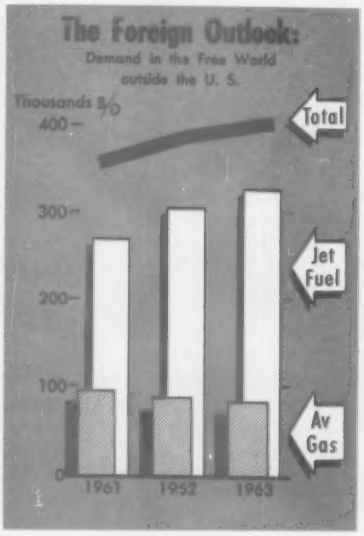
As of August 1, U. S. airlines were operating 259 turboprop planes and 169 turbojets. An additional 68 pure jets were slated for delivery this year and another 92 next year. In contrast, only 19 turboprops were on order for delivery this year and only 39 more during 1961.

A similar situation exists in the worldwide picture. According to figures based on Esso Air World surveys, there were 137 pure jets, 177 long-range turboprops, and 459 medium-range turboprops in service at the first of this year. Orders for jets were more than double those for turboprops. The table on page 51 includes all orders placed up to September 20.

While the number of long-haul jets in service greatly exceeds the shorter-range variety, the latter is rapidly catching up. As of September 20, there were 319 Boeing 707's and Douglas DC 8's in service or on order. This compares with 378 shorter-range jets, most of which are still to be delivered.

Plane builders anticipate that the big market potential of the future lies in this short to medium-range category. Boeing has estimated that during the next 10 years total sales will reach 1,000.

In the middle-range jet class, Boeing 720's, Convair 600's and 880's, and De Havilland Comets and 121's account for most of the planes on order. Early this year, United Air Lines contracted for 20 Caravelles, only short-range jet in the field. United was the first U. S. airline to order the Rolls-Royce powered French jet. Nineteen of the 20 are scheduled for delivery next year.



Utilization . . . In addition to increases resulting from more jets coming into service, demand also will be influenced by greater utilization.

Major airlines in the U. S. now have their jets in the air an average of 10 hours daily. Their goal, which is probably near the economic limit, is an average utility of 12 hours daily. Continental Airlines reportedly has almost achieved the 12-hour figure.

A 2-hour increase in utility would have a substantial effect on demand. With the big jets consuming more than 2,000 gal. of fuel per hour while they are in flight, increased utility could mean a demand increase of several thousand barrels daily.

Future jet fuels . . . Refiners see few supply problems ahead as long as military demand is for fuels of the JP-4 class and commercial airlines operate at subsonic speeds.

Minor adjustments may have to be made in fuel specifications and composition as more jet experience is accumulated. It is expected, however, that these will have little effect on refinery operations.

The supersonic-jet age which will eventually replace the present era of jet liners will pose another situation.

Worldwide Civilian Aircraft Orders:

	Delivered before January 1, 1960	Ordered for delivery in 1960	1961	1962	1963
Turbojets	137	294	168	18	80
Long-range turboprops	177	78	29	3	...
Medium-range turboprops	459	57	45	5	...
Totals	773	429	242	26	80

Types of Aircraft Ordered:

	Delivered by January 1, 1960	To be delivered	Total
Turbojets			
Airco D.H. 121	...	24	24
Boeing 707	81	81	162
Boeing 720	...	82	82
Caravelle	16	74	90
Comet	24	27	51
Convair 600	...	34	34
Convair 880	...	52	52
DC-8	16	141	157
VC-10	...	45	45
Long-range turboprops			
Britannia	56	1	57
Canadair CL-44D	...	17	17
Electra	121	49	170
Vanguard	...	43	43
Medium-range turboprops			
Avro 748	...	11	11
Argosy	...	7	7
Handley-Page Herald	...	9	9
Fairchild F-27	47	13	60
Fokker F-27	23	40	63
Viscount	389	17	406
Others (three mfrs.)	...	10	10
Totals	773	777	1,550

What U. S. Airlines Are Doing:

	Delivered by August 1, 1960	Ordered for delivery in 1960	1961	1962	1963
Turbojets	169	68	92	12	11
Turboprops	259	19	39	5	...
Totals	428	87	131	17	11

Today's jet fuels will have to be materially improved. To supply large volumes of these fuels may require the addition of special refining equipment.

Looking toward the commercial use of jets traveling at Mach-2 and Mach-3 speeds, much research is being carried out in oil-company and aircraft laboratories. They are searching for the optimum fuel which will meet the demands of both the airframe designers and the engine builders.

The researchers are faced with somewhat contradictory demands. Frame designers place great importance on extremely stable fuels of high density, such as polycyclic naphthenes.

Builders of Mach-3 engines emphasize the combustion advantages of low-density, highly paraffinic fuels.

Compared with existing fuels, either type would permit gains in payload or cruising range. Cost enters the picture, as the paraffin fuels are more expensive to make than the naphthenes. Possibly more important, however, are their comparative capacities as a fuel "heat sink"—a place where internal heat can be dumped.

As jets fly faster, the problems of cooling and fuel stability increase. At speeds of Mach 3 to Mach 5 a plane builds up pressure in the air around it, creating temperatures so high the air can't be used to cool the engine and other internal parts.

In Mach-4 flight at 60,000 ft., for example, stagnation temperatures of about 1,000° F. would be reached. This would be far too much heat to be absorbed into current jet fuels, which begin to break down into gum and carbon deposits when temperatures reach the 400-500° range. Thus the need for a heat sink.

Laboratory investigations and test flights with advanced types of fuels show that either highly paraffinic or naphthenic fuels can provide greater thermal stability at high flight speeds. They also provide a much greater heat sink than existing kerosine and gasoline-type fuels. Should still greater heat sinks be required, thought is being given to use of such low molecular-weight hydrocarbons as liquefied methane and propane (OGJ, Sept. 19, p. 78).

Improved fuels are available from refinery streams whenever the airlines and military gain sufficient experience to justify their use economically. A fuel with a high normal-paraffin content will cost some 2 or 3 cents more per gallon, it has been estimated.

Fuel problems . . . Several years' experience with jet-powered aircraft has removed most fuel-requirement problems. If nothing else, it has proved the turbine engine's inherent sensitivity to fuel contamination.

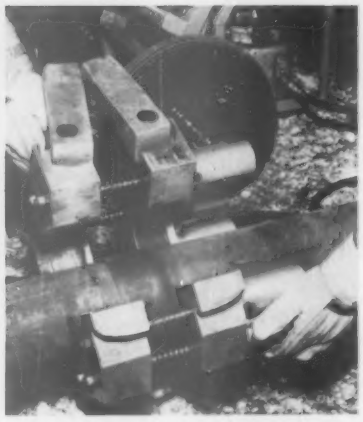
Through adopting rigid requirements as to how jet fuels are stored and handled, much progress has been made toward assuring that only clean, water-free fuel is delivered into the jet's tanks. Some complaints concerning contamination are still received, but the airlines in general are satisfied with the fuels they are getting. No specifications have been adopted as to solids content, but the general maximum set is 4 mg. per liter.

The commercial lines are quite satisfied with the −40° freezing point set for kerosine fuels. That it is adequate is indicated by the fact that the lowest fuel temperature encountered by a jet in domestic flight was −34°. This was recorded by a jet flying at approximately 31,000 ft.

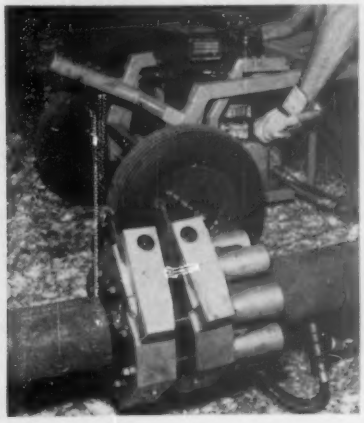
Airlines are well satisfied with the thermal stability of the fuels they are receiving. Some filming is reported with time, but not enough to be of concern. Adoption of an ASTM tentative method last year has made it easier to determine a tendency to decompose.

1 First step in gluing pipe is to apply epoxy to plain end of joint.

2 Inside of belled end is coated, then two ends are engaged.



3 Small, 35-lb. crimper is latched onto joint.



4 Crimping pressure is applied by small hydraulic duplex pump.

5 Finished joint looks like this. Crimping takes 25-30 seconds.

6 Taping finishes job. Elapsed time: 1 minute, 45 seconds.

You Can *Glue* Pipe Instead of Welding It

• Tex-Tube says jointing small-diameter line pipe with an epoxy glue speeds pipe-laying, cuts cost. Lack of tools will delay use of idea on big-inch lines.

Robert J. Enright
District Editor

THE DAY may be nearer than you think when pipeliners start gluing joints instead of welding them.

A new process using a tough epoxy glue and a simple crimping tool to join belled-end joints of strong, thin-wall line pipe is showing up favorably in the field on small-line gas, oil, and salt-water service.

Faster installation is claimed and at lower cost. And durability of existing glued lines has stacked up well also in areas where corrosive problems permit early comparisons.

The epoxy-joining process at hand is being pioneered by Tex-Tube, Inc., Houston. A crew paints epoxy on the outside of the unthreaded end of one joint and inside the belled end of another, engages them, latches on a small hydraulic crimping tool, crimps the joint, tapes it, and moves to the next joint.

The entire procedure, including the move, takes an average of 1 minute and 45 seconds.

Currently, the method is applicable only to 1½-in. through 4½-in. pipe because crimping tools are not yet available for the larger sizes.

Tex-Tube officials, however, say a 6-in. tool is coming out soon and an 8-in. tool will follow. Engineers are researching design and production of still bigger ones.

One of the nation's long gas lines is reported to be keenly interested in using light-weight pipe and epoxy jointing to lay main gathering trunks to hook into its big-inch main.

Laying time and costs . . . Small-diameter lines glued with the Tex-Tube process have been field-tested for more than a year, and have moved salt water, gas, and oil with no leaks.

In several cases, direct comparisons of costs of epoxy and welding methods have been made.

Recently an oil company used thin-wall pipe (0.109 in. wall thickness) and the epoxy method to lay a 20,000-ft., 4-in. gas line across a river-bottom swamp in Texas. The company had been losing conventionally welded lines about every 3 months.

The thin-wall pipe was glued in 1,500-ft. sections, which were winch-dragged into position by a truck and cemented in turn. There have been no leaks.

Cost of the thin-wall pipe used,

FINISHED PROJECT is this 4-in. gas line across a Texas river bottom.

Tex-Tube says, was 58% lower than that of conventional pipe. Installation time was reported roughly half that of welded lines. And cost of installation was cut 25%.

Generally, the company claims, an epoxy crew can lay about twice as much pipe in an 8-hour day as a conventional crew in an 8-to-10 hour day. This is based on information furnished by "three top-notch pipeline contractors."

Tex-Tube says an epoxy-jointing crew averages 125 joints of 2 in. pipe, or 100 joints of either 3 in. or 4 in., in an 8-hour day. Joint lengths in all cases are 40 ft.

The average installation cost for the epoxy process is about 2.4 cents a foot for 3 in. and 2.5 cents for 4-in. pipe.

The cost figures for the epoxy process include costs of the adhesive and of belling the pipe. The cost of renting a crimper is not included in the figures for the epoxy process. Neither is the cost of the pipe nor labor.

Tex-Tube claims the big saving comes in the number of joints that can be laid daily through the epoxy process. Labor costs also would be lower, the company says.

The cost added to the epoxy process by the rental fee for the crimper would vary according to how much pipe was laid in a day. Figuring 100 joints a day, it would come to an added 0.35 cent per foot.

A normal-sized welding crew for the small lines generally comprises a welder and welder's helper plus at least four other men. A welder, Tex-Tube points out, gets about $65-$70 a day and a welder's helper about $20 a day. This adds up to about $85 to $95 a day—or more than twice the cost of the crimper rental.

How it's laid . . . Currently, four unskilled laborers make up an epoxy crew. One paints the joint ends with adhesive. Two men work the crimping tool and a small hydraulic pump to actuate it. The fourth tapes and wraps the finished crimped joint.

The crimping tool, patented by the company and available for rental at $35 per day, is easily carried by one man. The 4-in. pipe crimper weighs about 65 lb., the 2-3 in. crimper about 45 lb.

The light-weight pump is wheel-mounted and pulls easily. It applies about 1,500 psi. to crimp a 2-in. joint, about 2,000 psi. to crimp 4 in.

After wrapping, the pipe can be placed in the ditch immediately. No line-up clamps are required at any time. If, however, the pipe is not "ditched" within 15 minutes or so after the joint is made, Tex-Tube recommends that it not be moved until the epoxy is completely cured. This requires about 48 hours.

Moving the pipe before epoxy is finished might cause cracks which would develop into leaks.

The key part of the method, the crimping, is probably the fastest of the operations. Crimping requires about 20 seconds on 2-in. and about 30-35 seconds on 4-in.

Conversely, the slowest part is brushing on the epoxy. Tex-Tube envisions development soon of a better way of applying the epoxy which also would make the method faster—a pressurized mixer and sprayer.

Corrosion battler . . . Tex-Tube predicts rapid growth of the epoxy process, especially in small-line service where corrosion is a problem. Used with internally plastic-coated, thin-wall pipe, the adhesive method stopped corrosion in several field tests where operators had suffered heavily.

Some humps ahead . . . Tex-Tube officials see some problems ahead before the adhesive process can be applied to big-inch pipe. But the company feels further engineering can take care of them.

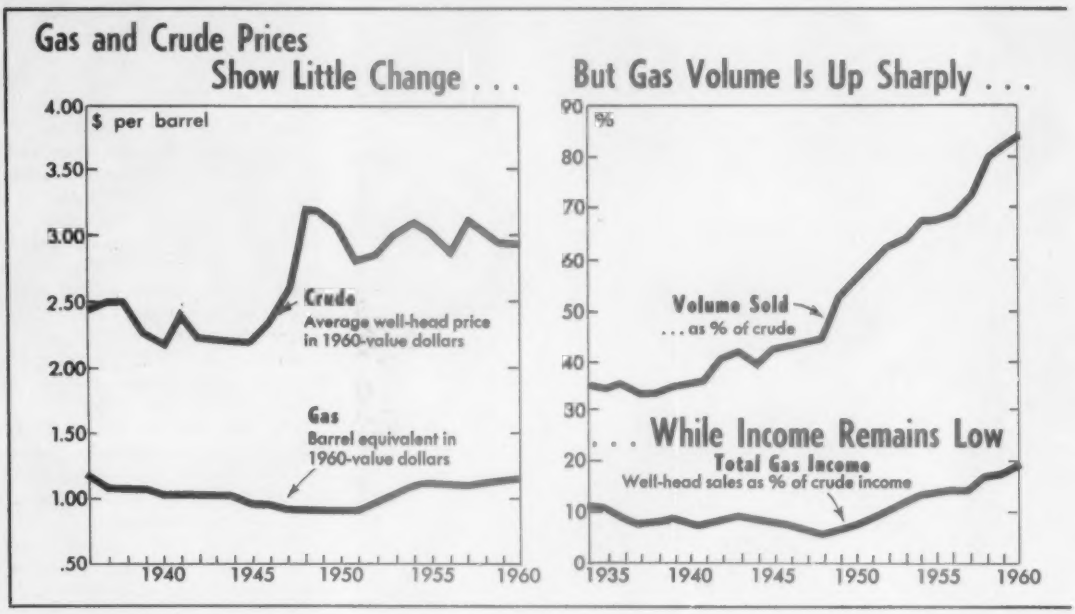
Perhaps the biggest hurdle is the development of a crimping tool that will do the job without being too cumbersome.

A second problem for the larger lines involves working pressures.

Tex-Tube now recommends maximum working pressures of 1,200 psi. for 3-in. and smaller epoxy-joined lines but just 800 psi. for the larger diameters. And gas-transmission lines would probably want no less than 1,200 psi. on larger lines.

Refinements in the epoxy process, however, are expected soon to increase safe working pressure to almost the yield strength of the pipe for all diameters, Tex-Tube says.

Another problem which is that the epoxy now used—originally developed by another firm under contract for the Air Force—sets much more slowly at temperatures below freezing. Tex-Tube is conducting tests of other similar adhesives.



Those Climbing Gas Sales Aren't a Blessing

THE sensational increases in natural-gas production since World War II continue to be a mixed blessing for the petroleum industry.

The charts clearly show the trend of events:

. . . Gas production in 1960 will equal 85% of crude output, in terms of energy, up sharply from 45.5% in 1948.

. . . Income from gas sales, however, will be only 20% of income from crude, also up sharply from 6.4% in 1948.

Thus, although gas is approaching the equal of crude in volume production, it still lags far behind as a revenue producer to the petroleum industry. Comparative values in 1948 were $5.3 billion for crude and $333 million for gas. The 1960 estimated values are $7.6 billion for crude and $1.5 billion for gas.

. . . Average well-head price of crude and gas combined has declined sharply since 1957 and has been on a declining trend since 1958.

The 1957 average price for oil and gas when converted to equivalents was $2.07 per barrel expressed in 1960 dollars. It declined to $1.88 in 1960. During this period, crude prices have eroded while gas prices generally have increased.

Reason for the declining price trend is the ever increasing sales of cheaper natural gas as compared with more expensive crude. The peaks in the price chart reflect periods when crude prices were increased.

The trend reflected in the average prices is beginning to be felt in the marketplace. Gas continues to displace crude from some markets and usurp new markets that formerly would have gone to crude.

The oil industry faces somewhat the same predicament as the auto in-

Oil Producers Endorse Louisiana's Proposed

LOUISIANA'S oil producers apparently have decided to settle for half the loaf where wide well spacing is concerned.

At a hearing held last week in Baton Rouge, almost all producers endorsed the general form of the Conservation Commission's suggested order 29-H which bases new-field allowables 50% on acreage and 50% on the well.

Only a few wanted to press for a 100% acreage formula at this time.

Conservation Commissioner James H. Gill announced no decision.

Action is expected within 2 weeks, and observers think the suggested order will be adopted essentially in the form set forth in August by the commission.

Spokesmen for several groups of land owners expressed fears that any new spacing order will reduce royalty income.

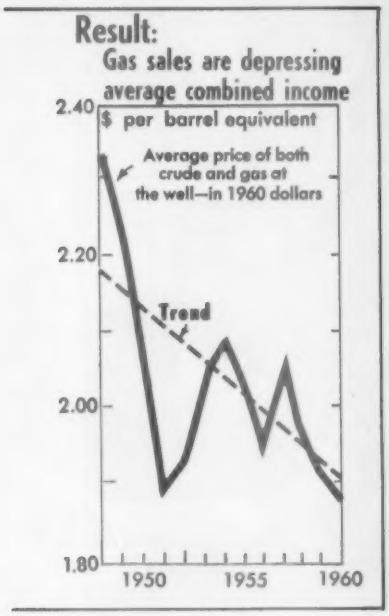
Here are the essential features of the order as originally proposed:

1. In new pools, basic spacing will be 40 acres with the maximum being 80 acres.

2. Allowable would be based on 100% of the depth bracket allowable for 40-acre spacing; wells with more or less acreage would have added or deducted an amount corresponding to 50% of the difference from the basic 40 acres.

3. Only pools drilled after the effective date of the order would be affected.

4. Increase for offshore and onshore wells on spacing greater than 40 acres would be the same in number of barrels. Percentage wise, the offshore wells would get less increase since their base allowable is higher.



Without Faults

dustry. The auto dealer is forced to sell compacts even though his bigger profit is in the larger models. The oil producer sells cheap gas, and this is hurting the market for his oil which is the profit maker.

Gas sold for 69 cents and crude for $2.92 in 1960 when expressed in barrels of energy equivalents in 1960 dollars. On the same basis, in 1957 gas brought 64 cents per barrel and crude $3.16. In 1948 the comparison was 45 cents and $3.23.

It's true that gas prices are up some. But they haven't risen enough to offset the decline in crude-oil prices.

New Formula

5. Pools shallower than 3,000 ft. would be exempt and exceptions would be given fields on completely faulted structures.

The majority view at last week's hearing was expressed by representatives of Continental Oil Co., which would prefer the 100% acreage system.

Conoco differed with the commission's original proposal concerning wells drilled on less than 40 acres. Conoco advocates that a well on 20 acres get half an allowable rather than 75%.

watching WASHINGTON

Clyde La Motte

• FPC shows signs of new "Take Charge" attitude . . .

THE FEDERAL Power Commission shows indications that it has come of age.

This was evident in the way it firmly came to grips with the complex problems in the pattern-setting Phillips gas case.

There have been times when the commission appeared timid, uncertain, and confused. It wandered among the trees, unable to see the forest, and seemingly became so enamored of detail and theory it lost sight of big-as-life facts and economic logic.

Perhaps this was understandable. After all, the commissioners were exposed to the influence of the FPC staff, much of which was so accustomed to utility-type regulation it immediately jumped to the conclusion that this must be the only method to apply to natural-gas producers.

Too, the commission took some severe cuffing from the courts, which put such emphasis on cost that virtually everything else was obliterated.

Finally, there was the endless stream of intervenors, presenting arguments for and against every conceivable regulatory approach. This would have taxed a Solomon.

Gradually, the commissioners began to have doubts about the wisdom of some of the advice and guidance from its staff. And they began to wonder if some of the mighty judges who had struck them down on occasion really understood the gas industry, particularly the producer segment with which the commission was dealing.

They began to question whether a fair and reasonable price simply meant the lowest price they could possibly assign.

Too, they became increasingly aware that there was no perfect, exact solution. And they knew they could not please everyone.

• Exposure to industry breeds understanding . . .

IT DAWNED ON the FPC commissioners, as they wrestled with case after case and heard theory after theory, that they were becoming more and more knowledgeable about the industry and its workings.

They began to realize that this experience was making them more expert in the field than many, and that it was their responsibility to exercise this experience.

So they set about to try to work out the best possible solutions on which a majority of the commissioners could agree.

The first really major result was the current Phillips case decision and the policy statement which accompanies it. This definitely marks a major turning-point at the FPC.

• Commissioners faced plenty of ups and downs . . .

TO A PERSON in a position to observe the FPC closely, the commissioners' battle was filled with drama, tragedy and, at times, a grim humor.

There was the tragedy of the death of Commissioner John Hussey, who was playing a key role in shaping the Phillips case decision.

There was the distracting uproar over the congressional investigation of outside "influence" at the FPC, and over President Eisenhower's decision not to reappoint Commissioner William R. Connole, a man who had definite ideas about how Phillips should be regulated.

And there were charges, made privately and made openly, that the commission simply could not handle that job, that some other method of regulation would have to be established.

Then, when the end seemed in sight in the Phillips case, Commissioner Arthur Kline became so bone-weary he was forced to rest during August. And Chairman Jerome Kuykendall often looked taut and drawn under the strain.

Obviously, the life of an FPC commissioner in such a setting is no bed of roses.

BEFORE the ruling: Frederick Stueck, Chairman Jerome K. Kuykendall, and Arthur Kline at work on the Phillips case.

FPC Maps New Gas-Regulation Policy

• Area pricing becomes the guide for fixing prices. This means rates will be set on the value of gas, rather than on the producer's costs, and this new approach may well reduce the backlog of cases and speed up projects.

Clyde La Motte
Washington Editor

THE FEDERAL POWER Commission last week, in its long-awaited Phillips case decision, took the most far-reaching steps of its 6-year struggle to regulate independent natural-gas producers.

The key points in the FPC action were the dropping of the customary rate-base approach for producer regulation, the switch to an area-pricing approach, and the issuance of a broad policy statement.

The policy statement (see text, p. 60) was a definite move away from a tedious case-by-case approach to the establishment of broad guidelines which would appeal to producers generally.

True, it was a tentative, cautious step which left many questions unanswered. Even one of the commissioners, Arthur Kline, termed it "too vague and inadequate."

But Kline concurred in the policy statement, nevertheless, saying it at least represents action rather than inaction.

And the commission indicated it will have additional policy statements to help shape further broad patterns.

1. Producer guidelines

For producers, the most heartening aspect of last week's developments was the clear-cut FPC rejection of the traditional original-cost, prudent-investment, rate-base method of regulating utilities.

The FPC said that its experience with producer rate cases has shown "beyond all doubt" that such a method is not sensible, or even a workable method of fixing the rates of independent producers.

"Producers of natural gas cannot, by any stretch of the imagination, be properly classified as traditional public utilities," the commission said in its Phillips case opinion.

And, perhaps for the benefit of consumer groups, the commissioners said the cost approach would undoubtedly mean higher prices all around.

It said it was "abundantly clear" that natural gas has been, in almost all instances, substantially underpriced.

"Since the cost-rate-base method seems almost always to produce the higher rates, it appears that consumers, in most instances, will be thoroughly protected if we place more reliance on existing prices and on applicable economic principles," the commission said.

Furthermore, it warned, rigid adherence to the rate-base method would price a great deal of gas completely out of the market.

What the FPC is doing, therefore, is switching to an area-pricing system which it feels is a more equitable and manageable plan.

2. Area pricing in action

Under the new FPC approach, the producer with gas to sell will know what rate to expect without facing a long, drawn-out rate base proceeding before the FPC.

And the producer with an existing contract calling for a rate hike will know whether that hike will push his price beyond that set for existing contracts in his area (see price table). If not, he can expect to get prompt approval.

New Pricing Approach in a Nutshell

- The FPC will use area pricing as the starting point for determining producer prices for natural gas. (Initial price guides for most existing producing areas are listed separately below.)
- There will be two price guides for each area: One price for new sales and the other for existing contracts.
- Prices on new sales will be accepted if they conform to the area price for new gas. Higher rates will have to be justified in a FPC rate proceeding.
- Area prices on established service will become a ceiling for price escalations in existing contracts, unless the higher price can be justified.
- Cost will be only a part of price determination.
- Cost data already obtained, together with other economic information, will be used to guide the commission in setting or changing area prices. The commission will continue compiling such data.
- Cost obtained from a representative sampling of producers in a given area will also be considered in setting area price guides. But the FPC will not try to get cost figures from every producer.
- The traditional rate-base method for setting prices will be abandoned. Instead, the FPC will seek to establish fair prices for the gas itself, and not for each individual producer.

In either case, if the producer feels the price ceiling is too low, he has two possible paths to a higher price.

He can undertake, in a formal rate proceeding, to convince the FPC that his particular set of circumstances calls for a better price.

Or he can, perhaps in league with some other producers in the area, attempt to prove to the FPC that an area price it has set is too low.

Regarding the two price system for each area now, the FPC indicated it expects the gap between the two will close over the long run so that there will be no distinction between new and old prices.

3. Role of cost data

Although the FPC intends to abandon the rate-base cost approach, costs will still figure in the agency's determination of prices.

However, this will not be done on an individual company basis. Instead, the FPC will take a "representative" sampling of costs in a given area and use that data as a part of the basis for fixing rates for all producers in the area.

The FPC stresses that costs will be only one of its yardsticks, and that current as well as future costs will be considered along with past costs to keep such data current in setting fair-price standards.

In arriving at area-price levels set last week, the FPC said it had considered all relevant facts, including not only cost information but existing and historical price structures, production volumes and trends, price trends over a number of years, exploration and development trends, trends in demands, and available markets.

The FPC's ultimate goal, as the commission sees it, is this:

"To set prices in all producing areas which will be adequate to maintain the gas supplies needed by the consumers of the nation, but at prices that are no higher than are necessary to accomplish that purpose."

4. Breaking the logjam

There is little doubt that the FPC move to area pricing and away from nothing but case-by-case handling was aimed in part at speeding up the disposition of producer cases.

The commissioners frankly admitted that they felt the situation would remain hopeless if they stuck with the individual rate-base approach predicated on detailed-cost data.

Pointing to the stack of unsettled producer filings it already has on hand, and considering incoming ones in the years ahead, the commissioners reached this conclusion: Even if the size of the present FPC staff were tripled immediately, the commission could not catch up with its workload until the year 2043.

This, in the commission's view, is an illustration of the administrative impossibility of separate determinations for all producers' rates.

However, there is danger of being overly optimistic that the new approach will clear the logjam in a hurry.

The commission itself anticipates one or more court challenges of its

Area Prices for Sales by Independents

IN ADOPTING the area pricing approach, the FPC has set up price levels by various geographic and district levels, as shown in the table. Initial service rates apply to new sales of gas. Increased rates apply to rate hikes applied for under old contracts already in existence.

Area	Cents per M.c.f. — Initial service	Increased rates
Texas		
District 1	15	14
District 2	18	14
District 3	18	14
District 4	18	14
District 5	14	14
District 6	15	14
District 7-B	14	11
District 7-C	16	11
District 8	16	11
District 9	14	14
District 10	17	11
Louisiana		
Southern	Not det.	13.7 (14)*
Northern	16.6 (17)*	13.7 (14)*
Mississippi	Not det.	13.7 (14)*
Oklahoma		
Panhandle	17	11
Other	15	11
Carter Knox	16.8	11
Kansas	16	11
New Mexico		
Permian basin	16	11
San Juan basin	12.7 (13)*	12.7 (13)*
Colorado	14.6 (15)*	12.7 (13)*
Wyoming	15	12.7 (13)*
West Virginia	26.8 (28)*	23.9 (25)*

*At 15.025 psia.

The Phillips Story: 12 Long Years

HERE is a calendar of key developments in the 12-year history of the Phillips natural-gas case, during which the fate of producer regulation has been hanging in the balance:

October 28, 1948—Original proceeding began when the FPC set about to determine whether Phillips was a natural-gas company within FPC jurisdiction, and whether Phillips' rates were just and reasonable.

August 16, 1951—Commission ruled that Phillips was not a natural-gas company, so FPC would not rule on its rates. The decision was appealed.

June 7, 1954—U. S. Supreme Court ruled that FPC must take jurisdiction over Phillips' rates even though Phillips was an independent gas producer and not an interstate pipeline company.

November 22, 1954—Because of the courts ruling, the FPC reinstituted its investigation of Phillips' rates.

June 26, 1956—Hearings began before a trial examiner, continuing for 82 days.

April 6, 1959—Hearing Examiner Joseph Zwerdling issued a lengthy decision which trimmed Phillips' proposed rates sharply. Phillips appealed to the full commission.

October 1-2, 1959—Full commission heard oral arguments.

September 28, 1960—Commission issued its decision, setting the stage for a new area pricing approach for all independent natural-gas producers.

current actions, particularly over its abandonment of the straight-cost approach.

Since it normally takes years to get a case all the way through to the Supreme Court, FPC's hoped-for pattern may be slow in taking shape.

And there undoubtedly will be efforts by individual producers and groups to get specific area prices changed. This will take time, of course.

So, while the logjam may not continue until the year 2043, it isn't going to vanish in the near future, either.

5. Legislation needed?

The commission's action last week does not mean that the industry no longer needs to give consideration to corrective legislation. In fact, this may increase the need.

Even those who approve of the new area pricing approach may feel that such action should be backed by specific legislation to assure its validity. As it stands now, the area pricing move is simply an administrative act by the FPC.

And there will be, of course, those who feel that the area pricing approach is wrong, or that it is inadequate.

One of the first industry reactions to the FPC announcement came from the Independent Petroleum Association of America.

It pointed out that there was nothing in the Natural Gas Act authorizing an area pricing approach and that the FPC, therefore, was "on unsure footing."

IPAA said further that the FPC has left many serious questions unsettled.

And it said that since the Natural Gas Act was originally written to apply only to the gas pipelines and not to producers—as the FPC itself concedes—the act contains no specific guidelines at all for producer regulation. That, in IPAA's view, is further reason why legislation is still imperative.

Although the association commended the commission for many of the views expressed in the Phillips case decision and the policy statement, IPAA said it does not think the area pricing approach will work.

"Our association a few months ago analyzed the area pricing approach and concluded it would be unworkable," IPAA said. "It appears, therefore, that we are likely to be led from one system of confusion to another."

In New York, K. S. Adams, chairman of Phillips, offered this early comment on the ruling: "Speaking blindly, without having read the order, it appears to be more favorable than unfavorable."

6. Impact on Phillips

Aside from its policy statement and general approach, the FPC action also included specific action on the Phillips case itself.

Despite the commission's own contention of the drawbacks to a rate-base approach, it used that very approach in the Phillips case.

It explained that it did so because the evidence in the Phillips case was presented on a cost basis—even by Phillips.

However, in using the rate-base method for Phillips, the FPC found that the company's revenues fell about $10 million short of its cost of service for the 1954 test year.

The commission concluded, therefore, that there was no point in making a further challenge of Phillips' proposed rate hikes.

What the FPC did, then, was this:

It terminated the proceedings, except in 2 of the 12 cases. This had the effect of putting the proposed hikes into effect although FPC did not set any rates.

However, since the rate hikes considered here were only those made prior to 1956, increases made by the company since that time will continue to remain suspended. Presumably, the area pricing ceilings will apply to them the same as to other producer rate increases.

The FPC, in concluding that Phillips' cost of service was higher than its revenue under the old rates made the following findings:

It found a cost of service of $55.5 million—or 11.309 cents per 1,000 cu. ft. Phillips had claimed a $92.3 million cost of service, but had filed a proposal last April offering to reduce this to $70.8 million.

The FPC allowed a rate of return of 11% as "fair" for Phillips, using a 3.2% cost-of-debt capital and an allowance of 12% for common equity. The trial examiner had proposed a rate of return of 9¼%, whereas Phillips had sought one of 17 to 18%

High Pressure Check Valve
Fig. 9160 10,000 lb WOG
Horizontal or Vertical

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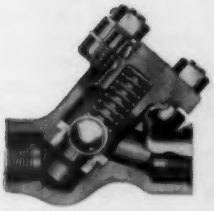

Ball Check Valve
Fig. 4632, Bolted Bonnet
Rating: 600 lb at 900F
(2000 lb WOG)
Horizontal or Vertical

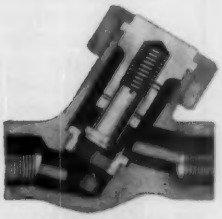

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Fig. 3578, Union Bonnet
Rating: 1500 lb at 850F
(3600 lb WOG)
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Text of FPC's Latest Statement of Policy

FPC STATEMENT OF GENERAL POLICY NO. 61-1

Establishment of Price Standards to be Applied in Determining the Acceptability of Initial Price Proposals and Increased Rate Filings by Independent Producers of Natural Gas.

THIS STATEMENT establishing rate standards for independent producers of natural gas is issued on our own motion and is based on our experience gained after 6 years of regulation of independent producers under the Natural Gas Act.

By this statement and the appended area-price schedules we will set standards for initial and increased-rate filings by producers for the sale of natural gas into interstate commerce. These standards will serve as a guide to us and to interested parties in determining whether proposed initial rates should be certificated without a price condition and whether proposed rate changes should be accepted or suspended.

Since the Supreme Court's 1954 decision in Phillips Petroleum Co. vs. Wisconsin, 347 U. S. 674, holding that under the Natural Gas Act the commission has jurisdiction over the interstate transportation and interstate sale for resale of natural gas by independent producers, and that such producers are "natural-gas companies" under the act, the commission's regulatory task has increased enormously in size and difficulty.

In contrast to the regulation of less than 200 pipeline companies prior to the Phillips case, under this decision commission regulation extendes to several thousand independent producers of natural gas. Although this producer segment of the natural-gas industry differs from the pipeline-transmission portion in fundamental particulars, its multiplicity of sales and services are now required to be covered by many thousands of rate and certificate filings under the act.

This ever-growing volume of additional rate and certificate filings has placed an increasing burden not only on this commission and other regulatory commissions, but on all those—consumers, producers, pipeline companies, and distributing companies as well—whose interests we must consider in administering the act.

It is essential, particularly in the interest of the consumer for whose protection the statute was enacted, that means be found for making the most effective use possible of the commission's limited facilities in discharging the new and additional duties called for by the regulation of producers of natural gas.

In our opinion, the price standards established by this statement will aid in effectively applying the provisions of the act to independent producers on a simple, clear and administratively feasible basis, and in a manner fair to all whose interests are affected by commission regulation.

Our many reasons for establishing these maximum acceptable rates as opposed to establishing rates based on a full cost-rate base hearing for every rate filing made by producers are set forth at considerable length in our Opinion No. 338, Phillips Petroleum Co., Docket No. G-1148, et al., p. 5-12, issued on this date.

Some further explanation is required of certain aspects of these area-rate levels. The geographical areas which we have used are convenient and well known. They are not necessarily in complete accord with geographical and economic factors which may be relevant to the establishment of pricing areas. As experience and changing factors may indicate, we will change or alter these areas from time to time in order to eliminate such inequities as may appear to exist because of our use of geographical boundaries.

In arriving at the price levels for the various areas set forth in the appendix to this statement, we have considered all of the relevant facts available to us. Such consideration included cost information from all decided and pending cases, existing and historical price structures, volumes of production, trends in production, price trends in the various areas over a number of years, trends in exploration and development, trends in demands, and the available markets for gas.

Of necessity, we have not set forth the adjustments to these prices which must be made to take into account every possible provision of every contract which may affect the actual price, such as B.t.u. adjustments, conditions of delivery, etc. The relevance of such adjust-

if the percentage depletion factor was not to be credited as a paid tax.

7. Tax incentives

In the Phillips case, the commission did not set forth as a specific item in the cost of service the tax incentives arising out of the company's use of a 27½% depletion, and the expensing of intangible well-drilling costs.

Phillips claimed it should be allowed as income-tax expense the higher amounts it would have paid in income taxes if these benefits had not been available.

The FPC noted that the total tax-saving amounted to only 6.63% on Phillips' well-mouth properties. Since a fair return would be higher than this under the contentions of any of the parties in the Phillips case, the FPC said, the result was not affected.

In other words, since the issue would have made no difference in this case, FPC did not attempt to take a policy stand.

However, the FPC did say that the company must have a fair return on its well-mouth properties, adding:

"Therefore, we do not set forth the tax incentives as a specific item in the cost of service, for we are allowing a larger return than permitted by the tax incentives."

8. Exploration costs

The commission adopted a modified B.t.u. method of allocating exploration costs between oil and gas.

The method is based on the relative heating value of the oil and gas produced by Phillips during the test year.

The FPC said the ratio of gas to oil is about 1 to 6, taking the B.t.u. content of 1,000 cu. ft. of gas and comparing it with a barrel of oil, the standard measures for the two fuels. Based on Phillips' 1954 field prices, however, the ratio is about 1 to 33, the FPC said.

The commission therefore applied an economic factor to the B.t.u. ratio to "correct its unreality" and to avoid imposing on gas consumers costs which should be borne by oil consumers—but at the same time to require gas to bear its proper share of costs.

This allocation resulted in a cost relationship of about 1 to 24 for Phillips, but the FPC stressed that these relationships might be different in other proceedings under different circum-

ments to the basic contract price and the appropriate established-price standard must be considered as each filing is made.

As it becomes apparent that certain adjustments have general applicability in a specific area, the area-price standard will be revised and set forth in greater detail with regard to the exact sale conditions to which the rate applies. We should, however, make it clear that these present price standards apply to pipeline quality gas as that term is generally understood in each area and, except for the Louisiana prices, are inclusive of all taxes.

Two price standards are set for each area. Initial prices in new contracts are, and in many cases by virtue of economic factors must be, higher than the prices contained in old contracts. For this reason, we have found it advisable to adopt two schedules of prices, one pertaining to initial prices in new contracts and one pertaining to escalated prices in existing contracts.

It is anticipated that these differences in price levels will be reduced and eventually eliminated as subsequent experience brings about revisions in the prices in the various areas.

It will be noted that we have omitted listing an initial-price level for sales from southern Louisiana and Mississippi. The proper initial-price level for these areas is currently the subject of two hearings pursuant to Supreme Court decisions, Atlantic Refining Co. v. Public Service Commission, 360 U. S. 378, and Public Service Commission v. FPC, 361 U. S. 195, FPC Docket Nos. G-11024, et al., and G-13143, et al., respectively.

Clearly, in light of these cases, it would not be proper at this time for us to establish an initial-rate level for these areas prior to a final determination of these cases.

These price levels, as announced by Appendix A attached to this statement, are for the purpose of guidance and initial action by the commission and their use will not deprive any party of substantive rights or fix the ultimate justness and reasonableness of the rate level. As with the areas, the prices will be adjusted from time to time as such facts as may come before us may compel such adjustments.

For the present, and in the absence of compelling evidence calling for other action by us, proposed initial sales of natural gas by independent producers which include rates higher than those indicated in the appendix attached to this statement shall be denied a certificate or certificated only upon the condition that lower rates be filed, and all rate changes filed under existing contracts which call for a rate exceeding the indicated price level in the attached appendix to this statement shall be suspended.

Where a proposed price exceeds the indicated rate level and is therefore conditioned or suspended we will, in determining whether the higher price is justified, not necessarily consider only the financial requirements of the individual producer proposing the price but will consider all of the above elements relevant to the industry generally in the area concerned.

Similar evidence will also be required from purchasers or their customers who object to any of the price levels or any specific price. Our determination will be in the nature of setting a price for the gas itself from any source questioned and not necessarily a price applicable solely to the party proposing some other price.

In this connection we urge that all parties who have any interest in changing an area price to join in such a proceeding leading to a determination of a proper revision, if any, in an area price or in the geographical area itself.

As there will undoubtedly be numerous parties with an interest in such a proceeding, full use should be made of pre-hearing procedures to reduce the factual issues and consolidate factual presentations to eliminate repetition and duplication of evidence.

Because of the impossibility of giving detailed instructions for every proceeding, the precise course of each hearing and the admissibility and relevant weight of each type of evidence must be determined as hearings proceed and we expect to issue additional policy statements from time to time clarifying various aspects of these procedures and principles.

The new area-rate determinations resulting from such proceedings will represent final determinations of just rates for the areas involved as of the date of the decision and for prior periods.

By the Commission.

Joseph H. Gutride,
Secretary.

stances. So other firms should not count on that ratio.

9. Purchased gas costs

The FPC accepted Phillips' contention that it should be permitted to adjust its purchased-gas costs to reflect the higher prices it will have to pay for gas it buys from other producers because of its own rate increases resulting from these proceedings. Under escalation provisions in Phillips' contracts, its cost of gas rises automatically if it is allowed to increase its rates.

10. Acreage in rate base

The FPC, citing the necessity for producers to acquire additional reserves, permitted Phillips to include in its 1954 rate base certain amounts representing undeveloped offshore leases held by a subsidiary as well as other undeveloped leases, even though there was no production.

It ruled similarly on the inclusion of certain producing leases even though they produced only minor revenues. The commission said that this was not sufficient grounds to exclude them, because reserves are often obtained and properly held for future needs for reasons beyond the producers' control.

The two rate-increase proceedings which the FPC left open involve possible future adjustments following final determination of rate-increase proposals by two pipeline purchasers.

Phillips based these two increases, together totaling slightly more than $2 million per year, on clauses in its contracts which permitted it to raise its rates in proportion to the purchasers' increases.

Since the pipeline companies' rates are now being collected subject to refund, the final determination of Phillips' rates must await FPC or court disposition of the two pipeline cases.

11. A three-man view

The Phillips case decision was handed down by a three-man commission. Participating members were Chairman Jerome Kuykendall, Commissioner Arthur Kline, and Commissioner Frederick Stueck.

The fourth member, Paul Sweeney, did not participate because he joined the commission after the case was nearly completed.

Journal Report on Refinery Runs

INTEREST in refinery runs is high these days. As a service to the industry, The Journal is initiating a monthly report on individual runs in five southwestern states which account for 40% of national refining capacity. Figures are obtained from state regulatory agencies. The table will appear in the first issue of each month hereafter.

THE 92 REFINERIES of Arkansas, Louisiana, Mississippi, Oklahoma, and Texas accounted for about 42% of U. S. crude runs during the summer months of 1960. This region followed roughly the same trend as the national industry, increasing July throughput 1.5% over June, then dropping runs by 2% in August.

Over-all, southwestern refineries maintained runs at about 90% of rated calendar-day capacity through the summer, contrasted with 83.5% for the nation as a whole. Some plants in the Southwest, however, were cut back to less than 80% as product stocks mounted.

For the region, summer runs were held at a higher level than during the first half of the year when run averages were just under 87% of capacity. This level corresponded to that of refineries in the Appalachian, Great Lakes and Mid-Continent. It was considerably higher than East Coast and West Coast, but fell far short of the 93% level maintained in the Dakotas, Minnesota and Wisconsin, which were charging mainly Canadian crudes.

ARKANSAS

(Refinery Runs in Barrels Daily)

Company and location	June	July	August
Amoco, El Dorado	34,209	29,301	35,119
Lion, El Dorado	33,013	33,461	34,618
Macmillan, Norphlet	3,783	3,786	4,533
Other	6,202	5,917	5,987
Total Arkansas	77,207	72,465	80,257

LOUISIANA

(Refinery Runs in Barrels Daily)

Company and location	June	July	August
Cities Service, Lake Charles	165,069	166,737	165,017
Continental, Lake Charles	46,841	38,455	46,942
Humble, Baton Rouge	300,980	306,350	308,474
Ingram, Meraux	15,902	17,235	16,410
Shell, Norco	96,894	106,802	109,289
Tenn. Oil Ref., Chalmette	22,700	30,858	35,032
Other	8,465	7,835	8,288
Total Louisiana	656,851	674,272	689,452

MISSISSIPPI

(Refinery Runs in Barrels Daily)

Company and location	June	July	August
Paluxy, Yazoo City	1,064	1,412	1,536
Pontiac, Hattiesburg	14,126	17,394	9,379
Southland, Sandersville	6,324	6,355	4,978
Total Mississippi	21,514	25,161	15,893

OKLAHOMA

(Refinery Runs in Barrels Daily)

Company and location	June	July	August
Allied, Stroud	2,736	2,420	2,581
Anderson-Prich., Cyril	10,536	10,166	10,589
Bell, Grandfield	6,429	6,545	6,517
Ben Franklin, Ardmore	11,293	11,037	8,634
Champlin, Enid	28,089	27,429	26,512
Cities Service, Ponca City	31,500	31,600	31,666
Continental, Ponca City	61,009	67,372	69,869
DX Sunray:			
Duncan	40,520	41,695	40,532
Tulsa	61,422	61,418	70,672
Kerr-McGee:			
Cushing	19,163	19,063	18,959
Wynnewood	17,189	17,060	17,252
Midland Co-op., Cushing	13,215	13,019	13,695
Phillips, Okmulgee	8,591	15,600	15,008
Texaco, West Tulsa	42,384	41,667	42,181
Total Oklahoma	354,076	366,091	374,667

TEXAS

(Refinery Runs in Barrels Daily)

Company and location	June	July	August
Amoco, Texas City	114,205	144,116	151,286
Am. Petrofina:			
Mount Pleasant	14,101	15,385	16,043
Wichita Falls	9,042	5,756	7,151
Atlantic, Port Arthur	65,896	65,199	64,340
Col-Tex., Colorado City	9,068	9,219	8,655
Continental, Wichita Falls	12,468	12,149	10,572
Cosden, Big Spring	30,387	30,713	30,615
Crown Cent., Houston	32,332	35,117	33,904
Danaho, Pettus	3,280	3,356	4,131
Delhi-Taylor, Corpus Christi	28,541	33,962	23,252
Delhi & Mayfair, Port Isabel	6,010	5,753	4,408
Eddy, Houston	2,198	2,046	2,126
El Paso, Odessa	13,735	13,679	13,631
Gulf, Port Arthur	261,886	266,171	186,374
Humble, Baytown	270,641	270,885	271,215
La Gloria, Tyler	15,755	15,599	16,276
Mobil, Beaumont	209,351	204,975	209,588
Phillips:			
Phillips	59,982	62,290	61,726
Sweeny	102,635	108,853	109,626
Pontiac, Corpus Christi	48,316	44,556	46,715
Premier:			
Fort Worth	7,692	7,387	7,577
Longview	5,531	3,331	4,620
Pure, Nederland	82,593	83,494	81,692
Republic, Texas City	27,753	23,700	21,147
Shamrock, Sunray	18,669	24,713	23,550
Shell, Houston	113,050	108,670	119,536
Signal, Houston	49,243	52,044	53,184
Sinclair:			
Corpus Christi	31,488	27,994	30,300
Houston	134,927	129,954	133,980
Skelly, Longview	3,081	1,563	3,139
Southwestern, Corpus Christi	37,857	35,453	29,477
Stand. Tex., El Paso	51,401	51,452	49,706
Suntide, Corpus Christi	39,384	39,920	41,036
Texaco:			
Amarillo	17,318	17,677	17,543
El Paso	13,585	13,542	13,232
Port Arthur	303,193	288,239	268,737
Port Neches	42,008	39,771	41,527
Texas City, Texas City	31,872	32,404	32,586
Other	20,204	21,699	23,109
Total Texas	2,340,678	2,352,786	2,267,312

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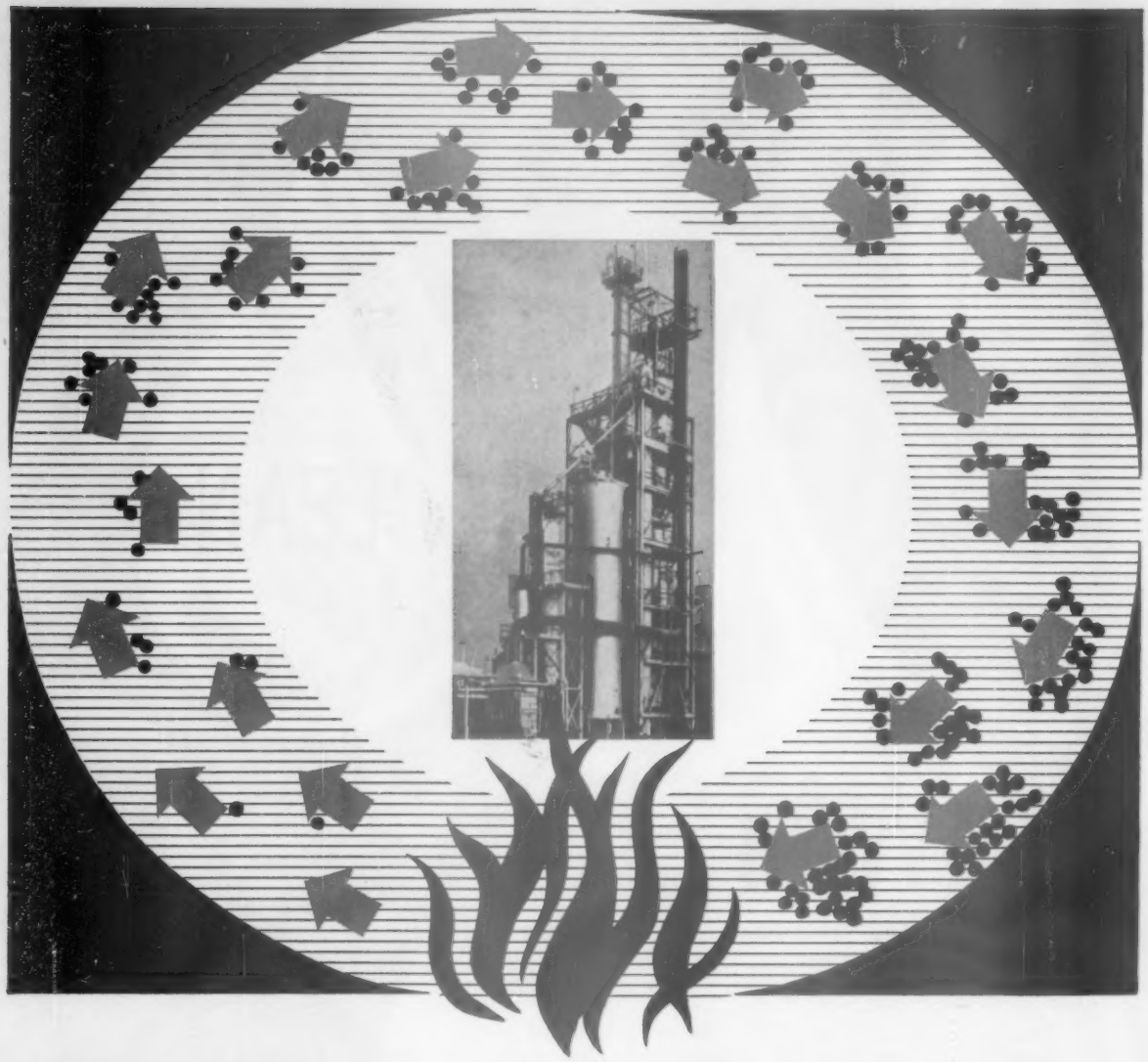

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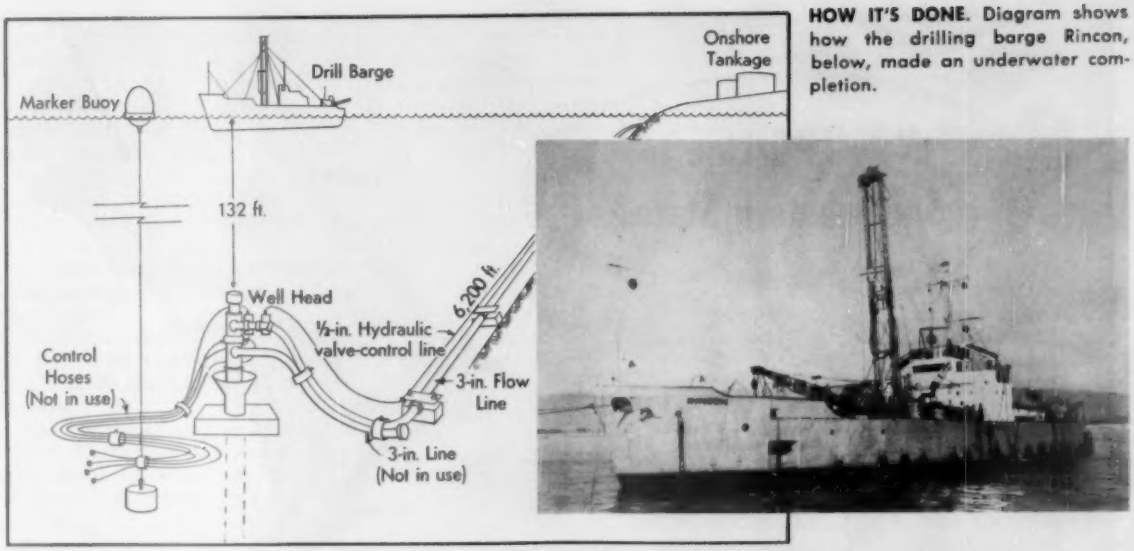


HOW IT'S DONE. Diagram shows how the drilling barge Rincon, below, made an underwater completion.

Underwater Completion Looks Economical

• Big savings in offshore work indicated in underwater completion made by Richfield and Cities Service off Peru. Well is making 200 bbl. daily from wellhead 132 ft. under water. All drilling, completion work done from ship.

A SHALLOW oil pool off the northern coast of Peru which defied normal offshore drilling and production techniques, is the proving ground for the first underwater completions in the open sea.

Peruvian Pacific Petroleum Co., a joint venture of Richfield Oil Corp. and Cities Service Co., has completed one well using a new underwater completion method and is making plans to develop the field with this new technique.

The discovery presented the operator with the problem of either coming up with a cheaper way of developing an offshore field or walking away from the discovery. Directional drilling could not be used since the pay sand is only about 1,000 ft. deep. This is not enough vertical depth to slant-drill wells. And building a series of offshore platforms, one for each well, could not be justified.

Faced with this problem, Richfield engineers developed the underwater completion method. The well was drilled and completed from a floating drill barge, the "Rincon," which was towed from California.

Divers connected a flow line to the wellhead and made underwater inspections, but Richfield believes it could make the completion without the divers.

No cost figures have been released on the underwater completion, but a spokesman for Richfield, the operator on the lease, said costs are "considerably less" than those of a normal offshore completion.

Other wells have been completed under water in inland waters and at more shallow depths (OGJ, Sept. 26, p. 91) but the Peruvian Pacific discovery is the first deepwater completion in the open sea.

What was done . . . The history-making discovery, Humboldt 3-3, is located 6,200 ft. offshore in 132 ft. of water.

The discovery flowed at the rate of 480 bbl. of 36.5°-gravity crude a day, but production has been cut back to 200 bbl. daily since the well was completed.

The well produces through a special high-alloy steel wellhead fabricated to Richfield specifications by Shaffer Tool Works Co., Brea, Calif. Production moves to onshore tankage through a 3-in. aluminum line. A second aluminum line is connected to the wellhead, but is plugged near it. The line may be used later if the well is placed on artificial lift.

Flow from the well is controlled from onshore with a ½-in. control line running to a hydraulic valve in the wellhead. There also are control lines running to a marker buoy above the well, but these are not in use. They may be used later for remedial work.

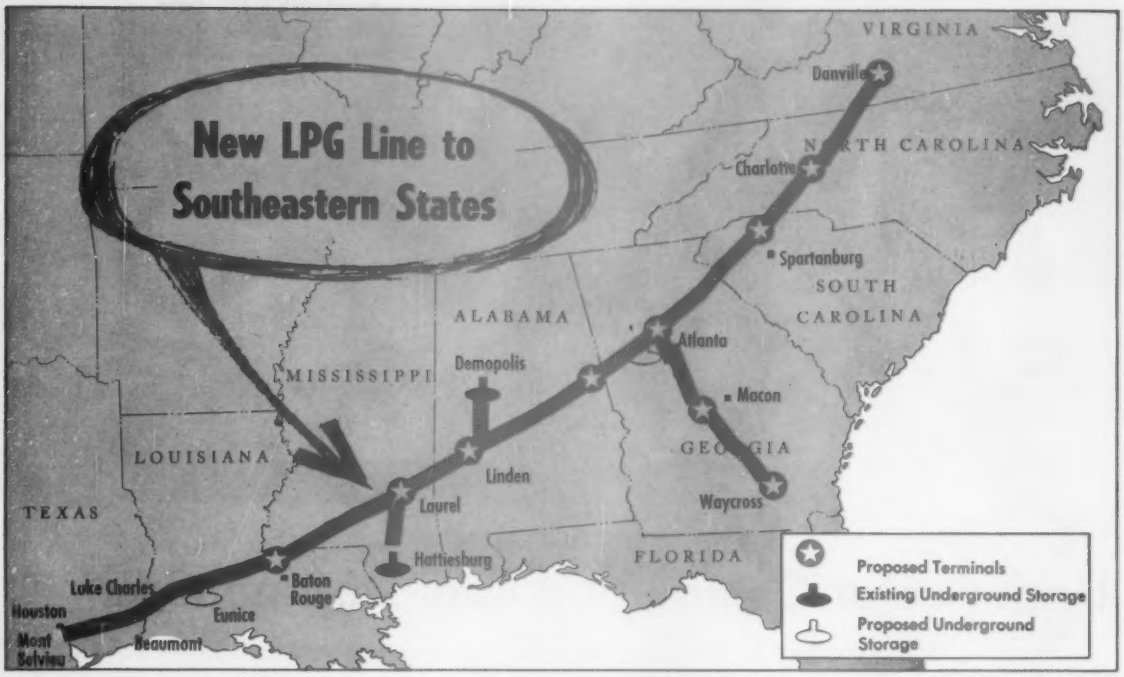
The underwater wellhead, which extends 12 ft. off the ocean floor, is equipped with double seals in all cases to protect against leakage. A "fail safe" valve on the wellhead remains closed unless held open by pressure from the ½-in. hydraulic line. And if the flow line is cut, pressure in the hydraulic line is relieved automatically to close the valve. Manual controls ashore and at the wellhead also are incorporated as a further protection against leakage.

The wellhead is installed from the drill ship. When the well is ready for completion, the blowout preventers are the last thing removed from the hole. Tubing plugs and the mandrel are run to the top of the hole and the preventers are removed and the wellhead installed after all valves have been plugged.

On the Humboldt 3-3, the operator set about 200 ft. of 8⅝-in. surface casing. The well is cased with 5½-in. and is equipped with 2-in. tubing.

The flow line . . . By using aluminum pipe for the flow line, the operator was able to pull the line offshore from winches on the drilling vessel.

The 6,200-ft. line was welded into one section and floated to the well location through anchored guide buoys. The pipe was then weighted and sunk into position. The ½-in. control line was tied to the aluminum line and laid at the same time. The aluminum line was in 50-ft. sections before being welded.



Transco Line to Move Gulf Coast LPG to East

• A new line with an initial capacity of 60,000 bbl. daily will serve an existing market. It's the country's second long-distance LPG line.

TRANSCONTINENTAL Gas Pipe Line Corp. is preparing to spend $63 million on an LPG line that will tap a potentially rich southeastern market and take advantage of Transco's right-of-way already held through the area.

Transco's directors last week unveiled the plan and announced they expect to have the line in operation for the winter season of 1961-62.

The line will have an initial capacity of 60,000 bbl. daily of propane and butane, and this can be increased somewhat by additional horsepower. At the beginning, however, the throughput will be less than capacity while markets are being acquired.

The Route . . . The main line will extend from Mont Belvieu, southeast of Houston, to Danville, Va., and will tap natural-gasoline plants, cycling plants, and refineries in Texas and Louisiana. Acceptance points will be near Mont Belvieu, Beaumont, Tex., and Lake Charles, Eunice, and Baton Rouge, La.

Terminals will be located near Baton Rouge, Laurel, Miss.; Linden and Roanoke, Ala.; Atlanta, Ga.; Greenville, S. C.; Charlotte, N. C.; Danville, Va.; Macon and Waycross, Ga.

Waycross and Macon will be served by a spur. Also spurs will connect storage facilities at Hattiesburg, Miss., and Demopolis, Ala., to the main line.

The line will be 12 in. in diameter at its heaviest throughput segment from Eunice to Laurel, a distance of 223.5 miles. It will telescope to smaller diameters to the east and west—down to 4 in. on the eastern end and 8 in. on the western end.

The main line will extend 1,080 miles, while spurs will add another 275 miles for a grand total of 1,355 miles.

Transco will be able to use the right-of-way of its natural-gas line from Eunice to Danville, a distance of 896 miles, although it will have to acquire additional width along this route for working room. All new right-of-way must be acquired from Mont Belvieu to Eunice and along the spurs.

The construction program also includes mining of underground storage caverns near Atlanta, with a capacity of 1 million barrels, and near Eunice, with a capacity of 350,000 bbl. At Eunice the cavern will be in salt domes and at Atlanta in a granite substructure.

Target date for start of construction on the line is next April and completion is scheduled by November 1.

The company . . . To build and operate the line, Transco created a wholly-owned subsidiary to be known as Trans-Southern Pipeline Corp.

Top personnel for the company will be drawn from Transco's organiza-

PROCESSING

Regular gasoline octane last month slipped slightly from the August level while premium held steady, the Ethyl Corp. survey discloses. Premium at 99.3 RON was the same as in August, and 0.1 above a year ago. Regular at 92.5 RON was 0.1 below August but 0.4 above a year ago. Highest octane premium was a 100.2 average for samples tested in Portland, Ore; highest octane regular was 94.3 in Buffalo, N. Y.

A **lubricating-oil** hydrotreater has started operating at Shell's Houston refinery. The unit, Shell's first, has a capacity of 6,500 bbl. daily and uses the company's trickle-phase process to remove sulfur and other impurities from lube oil. It will upgrade color, odor, and oxidation characteristics of low and high viscosity index lube-oil stocks and transformer oils.

tion, and chief officers will be announced shortly. Headquarters will be in Houston, where Transco is located.

Transco's board of directors met in New York last week to form the company and announce the building program.

Transco itself is one of the young giants of the booming long-lines transmission industry. It was formed in 1951 to move natural gas from Louisiana, Texas, and Mississippi eastward to the Atlantic seaboard and north to New York.

To finance the new project, Transco will go into the money market shortly. Details of the financing have not been disclosed.

Trans-Southern must go to the Interstate Commerce Commission for approval of its tariffs on the line, which will be operated as a common carrier.

The market . . . "This LPG pipeline naturally fits what we're doing," E. Clyde McGraw, Transco president said. "It is an allied project. The territory it will serve is transversed by our natural-gas pipeline. We will provide long-distance transportation through a common-carrier pipeline into a market now supplied largely by tank car.

"We will be serving an existing market, well blanketed with dealers, a market that would be using natural gas if it were available in the country. The chief uses will include home heating and cooking, tractor fuel, and tobacco drying."

The Trans-Southern line will traverse much of the area served with refined products by Plantation Pipe Line Co. McGraw said the two systems would not be competitive, as Plantation does not carry LPG.

Transco hopes to obtain a greater return on the liquids line than on its gas system, which is limited to about 6% by the Federal Power Commission. Transco will not ship its own product over Trans-Southern, and therefore will not be under the consent decree limiting dividends to shipper-owners.

The Southeast is already a large user of LPG, principally butane and propane, and demand is expected to be spurred further by construction of a pipeline which will cut shipping costs.

Trans-Southern's project is an example of the trend toward pipeline shipment of a growing percentage of U. S. products traffic—both refined products and LPG. Markets are served by higher-cost rail and truck until they become large enough to justify a pipeline, which then takes over the big volume, long-haul business.

Trans-Southern's line will be only the second long-distance pipeline built exclusively to move LPG. The first, now under construction by Mid-America Pipeline Co. from Eunice, N. M., to Minneapolis and Madison, Wis., will be completed late this fall.

Line sizes . . . The new line will have diameters as follows: From Mont Belvieu east (125 miles), 8-in.; from 125 miles east of Mont Belvieu to Eunice (58.4 miles), 10-in.; from Eunice to Laurel (223.5 miles), 12-in.; from Laurel to Atlanta (307.8 miles), 10-in.; from Atlanta to Charlotte (238.9 miles), 8-in.; and from Charlotte to Danville (125.9 miles), 4-in.

The three spurs will be 6-in. They consist of 215 miles from Atlanta southeast to Waycross; 25 miles from Linden, Ala., north to Demopolis, and 35 miles from Laurel south to Hattiesburg.

New Process Streamlines Sulfur Recovery

A NEW sulfur-recovery process employing molecular sieves may do away with one step in the conventional method of converting hydrogen sulfide to sulfur.

Krell and Associates, Inc. of Houston say their new approach will reduce capital costs about 33% and will be economic for plants as small as 10 tons of sulfur daily.

In the new process hydrogen sulfide is absorbed on synthetic molecular sieves, and elemental sulfur is produced in a special regeneration technique at temperatures of about 500° F. The conventional step of burning one-third of the hydrogen sulfide is eliminated.

Krell has assigned U. S. patent rights to Sulphur Recovery Inc. of Houston. In Canada, Maloney-Crawford Tank & Service Co. Ltd. of Calgary will handle the process under patent applications held by Western Sulphur Recovery Ltd., which will charge operating royalties. Western Gas Technologists Ltd. will be process engineers for Maloney-Crawford.

BRIEFS . . .

A new phenol plant will be built in the Texas City, Tex., area by Monsanto Chemical Co. The plant, which will manufacture 50 to 75 million pounds a year of phenol, is scheduled to be on stream in the spring of 1962. It will raise Monsanto's total phenol capacity to more than 200 million pounds. The company already operates phenol plants at Monsanto, Ill., and Avon, Calif.

The second polyisoprene plant to be constructed by Shell Chemical Co. will be near Marietta, Ohio. The company's first plant, at Torrance, Calif., is now being expanded to raise annual capacity to 40,000,000 lb. The Ohio plant will be able to produce 80,000,000 lb. a year. It is expected to be on stream in late 1961. C. F. Braun and Ralph M. Parsons companies are contractors for the new plant.

The oil allowable for October in North Dakota has been set at 63,872 bbl. per day, a decrease of 1,600 bbl. per day from the September allowable fixed by the state's Industrial Commission.

A pilot plant for making synthetic-stereo regular rubber will be constructed by Naugatuck Chemical Division of U. S. Rubber Co. at a cost of $2 million. Initial production will concentrate on ethylene-propylene copolymer and on synthetic balata, a specialty rubber selling for almost $5 per pound and used mainly for golf ball covers.

Fluor Corp. has sold its 60% interest in H. G. Acres & Co., Niagara Falls, Ont., process engineering firm. Conseco, Ltd., a company formed by 21 senior members of the Acres organization, made the deal with Fluor. Fluor bought control of Acres in 1953 but has been handling its Canadian work out of its Los Angeles headquarters the past 2 years.

A high-pressure, low-density polyethylene plant will be built at Beaumont, Tex., by Foster Grant Co., Inc. The plant, adjacent to Mobil Chemical Co.'s ethylene plant, is scheduled for completion in mid-1961. Officials say Foster Grant and Mobil Chemical will work together on development of high-pressure polyethylene and its applications.

Heyden Newport Chemical Corp.'s new 24-million-pound maleic anhydride plant under construction at Fords, N. J., is expected to consume 12,000 gal. of petrochemical benzene daily when it goes on stream in early 1961. The plant is being built by the Heyden Chemical Division.

In Prospect: A 10% Cut in Drilling Costs

- **Hughes officials tell contractors how a chart method of computing bit weight and rotary speed trims expense.**

THE NATION'S oil-well drillers have been told they can hope for a 10% slash in drilling costs soon.

Two officials of Hughes Tool Co., Houston, held out the promise of a cost reduction through a new drilling technique. It hinges on the use of bit weights and rotary speeds outlined in scientifically drawn charts.

At the meeting of the American Association of Oilwell Drilling Contractors in New Orleans last week, Henry B. Woods and Ed M. Galle explained the method. They presented four charts from which a contractor could determine his own program of bit weight and rotary speed.

These charts will be printed in an early issue of the Journal along with an explanation of their use.

Thus far, Hughes has employed the method on four drilling wells. Average saving on these was about 20% compared to offset well drilling in the usual manner.

Weights and speeds derived from the charts are not constant throughout a bit run. Rather, both weight and speed vary, starting low and gradually increasing as the bit dulls.

In their present form, the graphs are complex; there is a sliding scale on both axes of each chart.

In their complexity, the weight-and-speed charts are similar to the first attempts to calculate the best jet-bit hydraulics and the best placement for drill-collar stabilizers. Both hydraulics and stabilizer calculations have since been reduced to easily used table form.

Hughes is already considering putting the information from the weight and speed charts onto a special slide-rule.

Wear not constant . . . Woods and Galle base their work on these facts: 1. Bit teeth wear faster at high weights than at low weights; 2. Bit bearings also wear faster at high weights; 3. Teeth wear faster at high rotary speeds; 4. Drilling rate increases directly with bit weight; and 5. Drilling rate increases with rotary speed, but not directly.

With these facts in mind, the two Hughes officials showed that you get most out of a drilling bit when you start out at low weights and speeds. Doing so preserves both the bearings and the initial sharpness of the teeth.

Later in the bit run, weight and speed are stepped up to offset the slower drilling rate caused by dulling teeth.

To convert their principle to practical use, the Hughes men had to write mathematical equations never before derived. These equations show how quickly teeth and bearings wear.

Putting to field use . . . Woods and Galle said no new rig equipment need be bought to apply their method. They did note, however, that many rigs cannot vary rotary speed over a wide range without reducing power input to the mud pump.

Moreover, they said, the method "cannot handle drilling conditions such as crooked hole, rough running or drill-stem vibrations, and bit life limited by gage wear."

Woods and Galle did not recommend to the contractors that they blindly leap into a field trial of their method.

They simply showed how much saving might be made on a particular well, and recommended that the "contractors compare their actual drilling cost with the theoretical minimum cost" thus calculated.

If a saving seems likely, they said, the contractor should experiment on a complete well.

Like MCD . . . In essence, the calculations made by Woods and Galle are like those used by Humble Oil & Refining Co. in its minimum-cost-drilling—MCD—programs.

Main difference is that Humble uses electronic digital computers instead of charts (OGJ, Sept. 26, p. 147).

Humble has not disclosed its complete calculation system so that it might be used by others.

Both Hughes and Humble are aiming at what has been called "optimum drilling." Object is to calculate everything affecting drilling cost and to come up with the right combination of weight, speed, etc., to minimize the cost of each foot of hole.

Some of the factors considered are: Hourly cost of the rig, time to make round trips with the pipe, bit cost, formation hardness, formation abrasiveness, and bit weight and rotary speed.

Not considered are hydraulics, mud, and bit type; these things are figured in the normal manner.

Such methods as the one devised by Woods and Galle represent little time investment for the rewards possible in lower drilling cost.

NEW PRESIDENT of AAODC is John J. Moran. For other new officers, see p. 162.

Courses for drillers . . . Warren L. Baker, executive vice president of AAODC, told the meeting that training programs, seminars, and safety clinics are making a significant contribution to the drilling industry.

Contractors soon can take advantage of a crew-training course for internal

INDUSTRY

An all-time safety record was chalked up by workers in the nation's mineral industries during 1959, according to the Interior Department's Bureau of Mines. Fatal injuries dropped 10% from 30 per 100 million man hours in 1958 to 27 in 1959. The petroleum and natural gas industries achieved an over all 6.7% improvement.

Anderson-Prichard stockholders will meet October 31 to vote on the sale of assets of the company. Directors have approved sale of producing properties to Union Texas Natural Gas Corp. and Frankfort Oil Division of Joseph E. Seagram & Sons Distillers. Other assets would be sold to the newly formed Apco Oil Corp. (OGJ, Sept. 5, p. 91).

use of individual companies, Baker said. Work on the course, covering 20 topics ranging from insurance to formation testing, has been completed.

The AAODC-sponsored School of Advanced Drilling Technology has been held twice this year at Texas A & M College, and a third session is set for October 17-28.

Another drilling technology school will be held at Odessa Junior College, October 3 through November 11.

Baker said a Gulf Coast School of Drilling Practices is being held at the University of Southern Louisiana at Lafayette.

Seminars and short courses on drilling mud control and blowout prevention also are scheduled by the AAODC.

The association will reestablish its annual national safety clinic in 1961 because of renewed interest. Fifty-two companies have indicated they will send up to 130 persons to the clinic.

Seminars on federal wage hour and labor-relations laws have been held in six cities under association sponsorship. Two attorneys have conducted the 2-day course.

Baker said enrollment has been disappointing but that many who attended have reported substantial savings to their companies as a result of information obtained at the seminars.

In other reports on AAODC activities, Baker said the Interstate Commerce Commission is studying an application by the Oilfield Haulers Association to raise trucking rates 5 to 15% on hauls of 150 miles and less. The AAODC fought the application at ICC hearings in Washington.

Humble Plans Georgia Tests

HUMBLE OIL & Refining Co. is making two wildcat tests in the southeastern and southwestern corners of Georgia.

Eager to bring in Georgia's first commercial producer, Humble last week spudded a 10,000-ft. well in Wayne County in the southeast and will spud within a month a 4,500-ft. test in the waters of Lake Seminole in the southwest tip of the state.

The Wayne County well will be the deepest ever drilled in Georgia, a state that has experienced 93 dry holes since the first attempt 22 years ago.

Georgia has offered a bonus of $250,000 to the operator who brings in the first 100-bbl. well, but Humble already has spent $2 million in bonuses and rentals for leases and will spend another quarter-million on the Wayne County well.

The test is located 7 miles north of the town of Gardi on land owned by Union Bag & Paper Co. Humble has 750,000 acres under lease in that part of the state. Rowan Drilling Co. is the drilling contractor.

The well in Seminole Lake is just barely in Georgia. It will be drilled 2.9 miles north of Woodruff Dam on the Florida-Georgia border. A barge rig is being moved to the drill site from New Orleans via the Gulf of Mexico and the Apalachicola River.

Humble expects to spud during October, subject to approval by the U. S. Corps of Engineers of an application to anchor the barge in the Chattahoochee River channel of the lake.

Discovery Extends Deep Edwards Trend

DISCOVERY of a new deep Edwards lime field in Texas' mid-coastal region is considered one of the most significant finds in that area this year.

The new field, in southwestern DeWitt County, is more than 15 miles nearer the coast than any field on the "Deep Edwards" trend.

The discovery well, Texas Eastern Transmission Corp.'s 1 Harman A. Garbe, produces gas and condensate from a 29-ft. zone at 13,881-13,910 ft. Gas flow through ¼-in. choke tested 2,720 M.c.f. daily under pressure of 1,850 psi. Condensate was not gaged.

Production is the first in DeWitt County from the Cretaceous age, to which the Edwards belongs. The nearest Cretaceous production is in Persons fields, Karnes County, adjoining DeWitt on the west.

Pay zone of the discovery well is in the upper Edwards.

Two deeper zones in the lower Edwards also were tested, one at 14,054-76 ft. and the other from 14,393 to 14,452 ft. Both showed gas, but because of water no completion was attempted.

The deeper of these zones lacks only a few feet of equaling the deepest Edwards production.

BRIEFS . . .

The most northerly filing for Arctic Island rights is being made by Lobitos Oilfields Canada Ltd. The firm seeks 545,716 acres on west central Ellesmere Island and the east side of Axel Heilberg near the Eureka settlement. Approval would make Lobitos the largest single company land holder in the islands.

Winter operations may push geophysical operations toward the 90-crew level in western Canada. Contractors hope an early freeze-up will boost activity to more than double the current 43 crews.

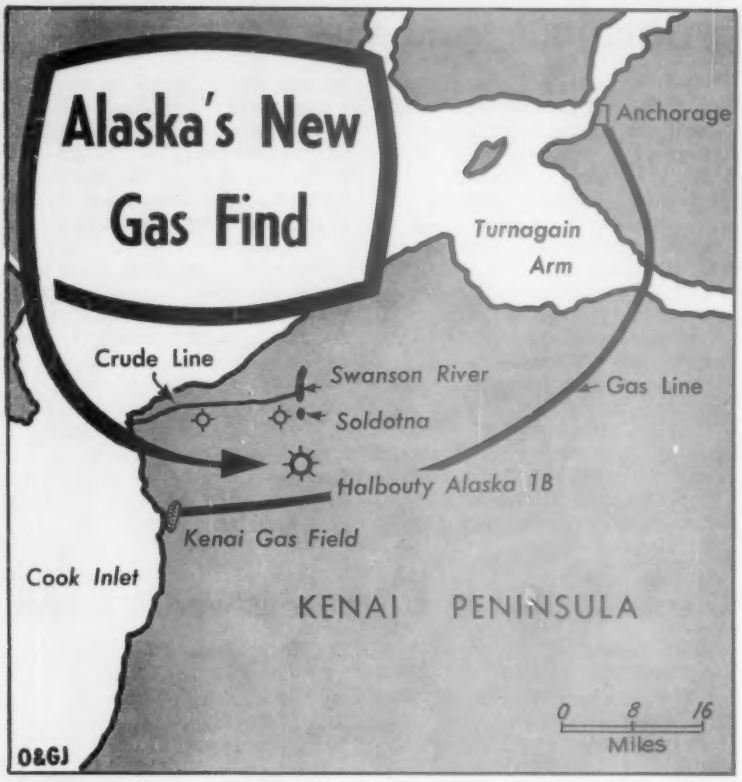
The formation of a wholly owned subsidiary, Offshore International, S.A., has been announced by The Offshore Co. The new subsidiary, a Panamanian corporation, will lease and operate drilling equipment on a worldwide basis. Currently it is operating two deep water mobile drilling platforms under leases to Pan-American International in the Persian Gulf and to Texaco-Trinidad Inc. in the Gulf of Paria.

A proxy fight aimed at ousting the management of Intex Oil Co., Bakersfield, Calif., producing and exploration firm, will be climaxed November 1 at a special stockholders meeting. Edward W. Saunders and Mrs. Edna M. Saunders, son and widow of L. W. Saunders, founder of Intex, are leading the drive to replace Intex's management. L. R. Seaman is president of the company.

A working interest in 1,000 acres in Rodriguez field, La Salle County, Texas, has been acquired by Texstar Corp., San Antonio, from Col. David Lee Hill, San Antonio. Texstar plans additional wells in the field and the initiation of secondary-recovery operations.

Operations are under way at a new million-gallon LP-gas distribution terminal of Union Texas Natural Gas Corp., located on President's Island in the Memphis industrial harbor area. The all-steel marine terminal serves the company's dealers in Tennessee, Arkansas, Mississippi and Alabama.

A merger proposal has won preliminary approval by directors of Northern Natural Gas Co. and Permian Basin Pipeline Co. Northern currently owns about 93% of the common stock and nearly 58% of the preferred stock of Permian. Stockholder meetings of the two companies to vote on the merger will be held November 30 in Omaha.



Halbouty Hits on the Kenai

. . . with his third well. The strike tests 80,000 M.c.f. daily. Development will wait until a market is found.

FOR the first time in 59 years, an independent operator has hit pay dirt in Alaska. Halbouty Alaska Oil Co., after two deep failures, has finally rung the bell on its third try.

After drilling the Halasko 1-B to total depth 14,019 ft., the operator plugged back for successful tests of Upper Tertiary sands and last week completed the well for an open flow gage of 80 million cubic feet per day. Producing interval is 4,992-5,020 ft. The Hemlock - Basal Tertiary sands, source of most Alaskan production to date, proved dry in the new discovery.

Michel T. Halbouty, Houston independent, heads up the Halasko firm. "This success," he says, "proves that all it takes in Alaska is persistence—and that the independent has just as good a chance up there as the majors."

Last independent production in Alaska was in 1901 when Chilkat Oil Co. and others completed several small oil wells in Katalla field in the Yakataga country in the southeastern part of the state. Last reported production there was in 1933 when the wells were abandoned after producing 154,000 bbl. from Miocene sands at 200 to 500 ft.

Halbouty has kept his rig in action almost constantly for the past 2 years. His first wildcat, the 1 King, 1 mile west of Soldotna field, was abandoned at 12,037 ft. in May 1959. The second try, the 1 Bishop Creek unit, 11-11, was plugged at 9,034 ft. in mid-September. Coastal Drilling Co. has sparkplugged all three operations.

The new gas well lies in 21-6n-9w, 6 miles due south of Soldotna and Swanson River fields, the only current production in Alaska.

"We think we have a good reservoir of some extent," Halbouty says. "The well is actually better than the gas wells at Kenai field, 16 miles to the west, and the production comes from only 5,000 ft. We also have three other sands of commercial value between 4,600 and 4,800 ft."

The three gas wells at Kenai, owned by Union Oil Co. of California and Ohio Oil Co., produce from approximately the same depth as the Halbouty discovery. They will soon be connected to Anchorage via Alaska's first natural-gas pipeline now under construction for Alaska Pipeline Co. Engineers have encountered great difficulty in pushing the line across the Turnagain Arm of Cook Inlet.

No ready market . . . Asked about a market for his new production, Halbouty declared he will pursue all possible angles for outlet facilities.

The pipeline from Kenai is expected to provide more than an adequate supply of fuel for the needs of Anchorage and Spenard, plus two large military establishments nearby. For the moment, Halasko will sit tight and drill no development wells until the market problem is solved.

The new discovery is on the east edge of a 3,500-acre tract; leases to the south are held by Union and Ohio. To the north are Standard of California and Richfield Oil Corp.

The new discovery has already been christened West Fork at the suggestion of government officials. "Why they named it that, I'll never know," Halbouty said. "But who cares as long as I got me a producer on my third try?"

Delhi-Taylor Moves to Buy Three States

DELHI-TAYLOR Oil Corp. took a big first step last week toward an acquisition of Three States Natural Gas Co.

Moving quietly, Delhi - Taylor bought a reported 2,400,000 shares or 40% of Three States common stock, principally from officers of the latter firm.

Three blocks of shares were involved. John A. McGuire, Three States board chairman, confirmed that he had sold 700,000 shares. Purchase of another 700,000 shares was reportedly made from W. H. Hudson, president. Another million were bought from an undisclosed source.

Delhi-Taylor is an integrated company headed by Clint W. Murchison as board chairman and J. L. Sewell as president.

Three States is an independent producing firm with oil and gas production primarily in Texas, New Mexico, and Utah. It holds concessions in other areas, including Alaska and Australia.

Three States recently reported its producing properties worth $21,591,151, with nonproducing properties and equipment worth about $2,500,000 more.

Exporting Countries Endorse OPEC

• Governments represented at the Baghdad meeting are eager to join the organization which may unify major oil exporting countries. A principal goal of OPEC: To devise a system which will insure stable prices.

MAJOR crude exporting countries were one big happy family last week as enthusiastic delegates headed home from one Middle East conference, and preparations moved forward for another.

The governments of four out of five oil countries represented at Baghdad showed their determination to keep up oil prices through joint action by quickly approving resolutions of the fledgling Organization of Petroleum Exporting Countries (OPEC). These call for a mutual stand to push up prices to levels preceding the August price cut, and to present a unified oil policy in the future.

At the same time, Arabs were dusting off their economic arguments in advance of the second Arab Oil Congress to be held at Beirut starting October 17. These arguments call for a bigger slice of oil profits for producing countries, and a bigger voice for Arabs in the world-wide oil business.

Approve Baghdad decisions . . . While the bubble may break when put to test, OPEC was assured of a good beginning when two of the countries expected to have the greatest doubts gave it quick approval. These were Iran and Kuwait. Kuwait's action is at least partly due to two price cuts in 2 years, which, according to its Finance Ministry estimates, cost the country $60 million a year.

Iraq and Venezuela have also given their consent. Saudi Arabia was expected to immediately follow suit since its Director General of Petroleum and Mineral Affairs, Shaikh Abdullah al-Tariki, was a leading backer of the conference, along with Venezuela's Dr. Juan Pablo Perez Alfonzo (OGJ, Sept. 26, p. 120).

The main points of the official statements covering possible proration, the attitude toward oil investments, and joint action follow. The members think these points are historic:

. . . **"Members shall study** and formulate a system to insure the stabilization of prices, among other means, by the regulation of production, with regard to the interests of the producing and of the consuming nations, and to the necessity of securing steady income to the producing countries, an efficient, economic, and regular supply of this sort of energy to consuming nations and a fair return on their capital to those investing in the petroleum industry."

. . . **"Members will require** the oil companies to maintain their prices, stable and free of any unnecessary fluctuation; that they (the companies) will try by all means at their disposal to reestablish current prices at the levels prevalent before the reductions; that they will assure that in case some new circumstances arise which, according to oil companies, require price changes, the companies should enter into consultations with the member or members affected in order to fully explain the circumstances."

. . . **"The principal objective** of the organization will be the unification of petroleum policies by the member countries and the determination of the best means for safeguarding the interests of member countries individually and collectively."

OPEC will meet at least twice a year, and possibly more often, in a capital of one of the member countries. A subcommittee will meet in Baghdad later this year to set up a structure and budget for the organization.

One result of the Baghdad meeting may be that it will put the initiative in Middle East oil affairs in the hands of producing countries, rather than the United Arab Republic, which has frequently assumed the role of spokesman for Arab oil.

New members must have unanimous consent of OPEC charter countries to join and there is some speculation that an application by Eqypt might face a blackball by either Iran, with which it has strained relations, or with Iraq, its traditional rival for Middle East leadership.

Qatar, which was represented at the meeting as an observer, has already asked to become a full member.

Beirut preview . . . Most OPEC members are expected to be present at the Arab Congress meeting in Beirut. One item of discussion among those attending is expected to be a recent call for a new look at oil pricing and company-government profit splits.

The new pitch was made in a paper by two staff members of Shaikh Tariki's staff. The paper expresses their private views, but it hints at the line Arab oil leaders may take.

The authors, Hisham Nazer and Mohamad Joukhdar, say: "The intrinsic value of Middle East oil should be derived from the differential between the actual cost of production in the Middle East and that for the marginal firm in the United States."

They argue that a price pegged to U. S. costs is not too high and that "oil producing countries of the Middle East . . . cannot afford any longer to dispose of their oil to any center of consumption at a price level less than what would have to be paid for a similar oil from other places."

At the same time the authors contend that royalties should not be counted in the sum total in working out the profit split.

Brazil Gives Coffee For Russian Oil

BRAZIL has revealed some of the details of a barter agreement with Russia under which it will import 1.8 million tons of oil, or about 12,000 bbl. daily, over the next 3 years.

Annual shipments of 600,000 tons of crude and products will be valued at $10 million this year, $13.5 million in 1961, and $15 million in 1962. Oil industry equipment valued at $3 million also will be delivered by the Russians each year in the period.

Brazil on its part will ship 20,000 tons of coffee per year to Russia along with cocoa, vegetable oils, skins, and other products.

Gulf's Hunt in Central Bolivia Pays Off

• Several pays are found in a well northwest of Santa Cruz. The location is fairly near a pipeline serving refineries in four other cities.

GULF Oil has ended its 4-year drought in Bolivia with a 325-bbl. daily discovery 30 miles northwest of Santa Cruz.

An affilliated company, Bolivian Gulf Oil Co., encountered several pays in Caranda 1. The discovery flowed light, 50° - gravity crude through a ¼-in. choke from perforations at 5,850 ft. A lower interval tested oil of similar gravity. Other shallower prospects have not yet been evaluated.

Three Tulsa firms share a 20% interest in the operation. They are Williams Brothers Sudamericana, Ltd., Falcon Seaboard Drilling Co., and Berry & Reiner, Inc.

The discovery is on a concession of about 1,200,000 acres in South-Central Bolivia in Oil Zone 1. Gulf acquired 3,750,000 acres in 1956. This was later expanded to a total of 8,650,000 acres. The company is developing another 1,110,000 acres under a contract with the government oil agency, YPFB.

The find, if commercial, will give a long sought boost to Bolivian crude output which has held steady around the 8,700 bbl. daily level for several years. All crude production at present is handled by YPFB.

Others working . . . More than a dozen private companies besides Gulf either hold concessions or are drilling under contract on blocks located in a YPFB reserved zone.

One of these, Bolivian Oil Co., will

supply distillate from gas wells in Madrejones field, which straddles the Argentine-Bolivian border, for a new 920-mile 12-in. pipeline to San Lorenzo, Argentina. Bolivian Oil is the operator for a group formed by Fish Engineering, Bolivian and others to explore a 108,000-acre border tract under a contract with YPFB. Partners include North American Utility & Construction, Petroleum Machinery Services, and TIPSA.

YPFB keeps 10 rigs active, of which four are generally on wildcats, and six on field development.

Private operators have a total of five rotaries in operation. This includes another Gulf outfit drilling a wildcat to 2,445 ft. in Izozo 1. The Fish group has two rigs at Madrejones field.

Chaco Petroleum is drilling Palo Mercado 2 on a 900,000-acre concession in southern Bolivia formerly held by Glenn McCarthy, Inc. Chaco is a wholly-owned subsidiary of Tennessee Gas. It is operator on the acreage held under contract with YPFB by the TULM group composed of Tennessee and three partners, Union Oil & Gas Corp. of Louisiana, Lion Oil Division of Monsanto, and Murphy Corp.

Other companies with concessions include affiliates of Royal Dutch-Shell and California Standard; Andes Oil (Hancock, Pure, Sohio); Bolivian American Oil (Consolidated Cuban); Bolivian Petroleum (Drillexco, Atlantic Refining); Cataract Mining; White Eagle International Oil (Helmerich & Payne, Western Hemisphere, Blackwell); and Bolivian Texas Co. (Texas Natural Gasoline).

One of the four private Brazilian companies with concessions expects to start operations in the near future. This is Uniao Brazil, S.A., which has a 568,000-acre tract managed and operated by Kerr-McGee Oil Industries. Other Brazilian concession holders include Petroleo Da Bolivia, Cia. Petrolifera Brasileira, and Petroleo Andino.

Apex Gives Approval to BP's Merger Offer

THE BOARD of an important Trinidad crude producer has accepted a takeover offer from British Petroleum Co.

If stockholders approve, Apex (Trinidad) Oilfields Ltd., will merge with BP in a stock exchange deal, in which 1 £ of ordinary BP stock plus 4 shillings 6 pence (about 62 cents) will be given for each 5 shilling stock unit of Apex.

The board said it accepted the offer because it is becoming increasingly difficult for the smaller independent crude oil producer to operate as profitably as in the past. It said increased wages are adversely affecting profits.

Another factor cited by the board is the possibility of less crude revenue. Apex has a crude sales contract with Texaco that expires at the end of this year. And Texaco has proposed a lower crude price on the renewal contract.

Apex has oil rights covering 64,100 acres in Trinidad, with about 477 wells producing 12,500 bbl. daily. It also has 25% interest in Canpet Exploration Ltd., formed to deal in oil properties in Canada.

BP is already active in Trinidad through BP Exploration Co., which holds one-third interest in Trinidad Northern Areas which produces several thousand barrels daily from Soldado field on the Trinidad side of the Gulf of Paria and 16 miles off the southwest corner of the island.

The proposed merger of Apex and BP has been under consideration by the two companies for several months.

BP also holds 77% interest in Trinidad Petroleum Development Co., which produces about 17,000 bbl. daily. The company's oil rights include 59,100 acres on the mainland and 225,000 acres offshore in the Gulf of Paria and off the south coast of Trinidad.

Last year Trinidad Petroleum drilled its first well in the Gulf and reported that oil was found.

PARTICIPANTS IN Mexico City conference were, from left, Dr. Juan Jose Bruno, YPF president; Pascual Gutierrez Roldan of Pemex; Dr. Eugenio Zubasti, YPF director; and Marcos Soifer, production manager of YPF. They announced . . .

Mutual Assistance Planned by Pemex and YPF

MEXICO and Argentina decided last week they will invest in each other's oil industry.

And, says Pascual Gutierrez Roldan, director general of Petroleos Mexicanos, this will be just the first step toward developing an "international agreement" involving also Bolivia, Brazil, Peru, and Venezuela.

In a joint press conference in Mexico City, Gutierrez and top Argentine officials disclosed that Yacimientos Petroliferos Fiscales, the Argentine oil agency, will invest money in construction and operation of Mexican tetraethyl-lead and synthetic-rubber plants.

Mexico, on the other hand, will invest in Argentine tetraethyl lead and petrochemical plants.

The Mexican oil-agency head described the arrangement as a "mutual assistance program."

Eventually, he said, by mutual investments and joint operations, the six Latin countries will form a "bloc to defend a common market." It will be, he added, an international consortium to "protect free Latin America from foreign oil monopolies."

When asked how the Latin countries will finance the joint ventures, Gutierrez said: "That will be worked out."

Gutierrez said there will be a meeting of all six countries next year to determine ways and means of developing the program.

Just before announcing the program with the Argentines, Pemex had entertained a delegation from Bolivia. This meeting was to explore the possibilities of a Mexican exploration and development program in Bolivia.

This week Alfonso Barnetche; head of production for Pemex, and Eduardo Guzman, assistant manager of exploration, are scheduled to be in Bolivia for further negotiations.

Further pointing to the present international thinking of Mexico's Gutierrez was the fact that Garcia Rojas, Pemex manager of exploration, last week was in Africa.

Soviet Oil Cargoes Fill Cuban Needs

CUBA RECEIVED more than enough oil from Russia in August to keep its nationalized refineries in operation.

Alfonso Gutierrez, director of the Cuban Petroleum Institute, said shipments totaled 2,087,480 bbl. of crude and products during the month.

This represents about a 35-day supply under normal demand conditions of 65,000 bbl. daily.

Crude shipments of 1,609,527 bbl. accounted for most of the deliveries. Product deliveries included 325,337 bbl. of gasoline, 129,596 bbl. of kerosine, and 23,020 bbl. of avgas.

Gutierrez said Soviet deliveries were made by 14 tankers. Eight were Russian and the balance were under British and other flags.

The Cuban Government, with the help of Russian technicians, has been operating the island's three major plants since Premier Fidel Castro ordered a takeover 3 months ago. The confiscated plants included Texaco's 20,000-bbl. plant at Santiago de Cuba, Esso's 36,500-bbl. plant at Belot, and Shell's 27,000-bbl. plant at Havana.

Meanwhile, a Cuban company which tried to buy refinery parts in Houston apparently folded its tent and crept away.

This caused some surprise because officials of the company had insisted that it would stay in business.

Offices of the company, Ferreteria Caunedo, were vacant last week. The landlord had instructions to forward mail to a Houston postoffice box number.

Julio Caunedo, an official of the firm, had said earlier in New York that he was trying to buy any kind of hardware, including parts for the expropriated American refineries.

The Cubans went to Houston with cash to do business, but they apparently found no takers.

World Output Slips

• Total free world production in July drops to 17,303,100 bbl. But Kuwait's flow increases.

A SUMMER SLUMP was apparent in the world-wide crude production picture in July as output declined for the second month.

Lower production was shared by the United States, Canada, and virtually all the major exporting countries, including Venezuela, Iran, Iraq, Saudi Arabia, and Indonesia. The exception was Kuwait, where output rose to the 1.7-million-barrel daily level for the second time in history.

Oil from Algeria continued to increase its foothold in world markets with another high of 170,300 bbl. daily. CREPS, a French-controlled company owned 35% by Royal Dutch-Shell, accounted for 2,700 bbl. daily from the Edjele area of the eastern French Sahara. The crude served as line fill for the 460-mile 24-in. pipeline system to La Skirra, Tunisia, now going into operation.

The sharp reduction of Trinidad output to 68,500 bbl. daily resulted from an 18-day oil workers' strike on the island.

TREND OVER THE LAST YEAR

	Western Hemisphere less U. S.	Middle East	Total free world outside U. S.
1959			
July	3,922.8	4,536.1	9,350.3
August	3,862.1	4,659.7	9,344.9
September	3,887.5	4,635.5	9,396.4
October	4,069.6	4,699.2	9,629.8
November	4,123.2	4,820.7	9,877.9
December	4,218.5	4,682.0	9,861.5
1960			
January	4,316.5	5,065.3	10,334.7
February	4,389.5	4,986.5	10,313.2
March	4,156.4	5,146.3	10,346.8
April	4,069.5	4,925.5	10,055.1
May	4,317.4	5,286.2	10,680.2
June	4,285.4	5,164.5	10,568.2
July	4,207.5	5,105.8	10,443.1

World-Wide Crude Production: Daily Average in Thousands of Barrels

Country—	July 1960	June 1960	July 1959
Western Hemisphere			
Argentina	167.8	161.1	119.9
Bolivia	8.4	8.4	9.1
Brazil	76.0	76.0	72.2
Canada	525.0	532.0	491.4
Chile	19.0	18.9	17.7
Colombia	160.4	155.9	148.9
Cuba	0.2	0.2	0.5
Ecuador	7.8	7.8	7.6
Mexico	267.1	267.1	262.0
Peru	52.2	52.2	48.4
Trinidad	68.5	117.7	112.4
Venezuela	2,855.1	2,888.1	2,632.7
Total	4,207.5	4,285.4	3,922.8
Europe			
Austria	45.3	46.0	46.3
France	39.7	39.5	33.7
West Germany	108.0	106.9	100.0
Italy	40.4	39.4	32.6
Netherlands	37.4	36.5	33.5
United Kingdom	1.7	1.7	1.6
Yugoslavia	19.5	17.8	11.8
Total	292.0	287.8	259.5
Middle East			
Bahrain	45.1	45.0	45.0
Iran*	950.0	961.0	907.0
Iraq*	895.0	1,010.5	827.9
Israel	2.0	2.0	2.0
Kuwait	1,700.2	1,595.5	1,394.8
Neutral Zone	132.0	131.0	121.8
Qatar	177.0	172.7	167.0
Saudia Arabia	1,198.1	1,240.4	1,062.7
Turkey	6.4	6.4	7.9
Total	5,105.8	5,164.5	4,536.1

Country—	July 1960	June 1960	July 1959
Other Asia			
British Borneo	103.0	103.0	112.4
Burma	10.5	10.5	10.8
India	8.5	8.5	8.5
Indonesia	427.3	441.5	382.7
Japan	10.1	9.7	7.5
New Guinea	4.5	4.5	4.4
Pakistan	5.9	5.9	6.3
Total	569.8	583.6	532.6
Africa			
Algeria	170.3	153.6	18.6
Angola	1.0	1.0	0.9
Egypt	62.5	59.9	53.4
Gabon	16.8	15.0	15.4
Morocco	1.9	1.9	2.0
Nigeria	15.5	15.5	9.0
Total	268.0	246.9	99.3
Free World			
Foreign	10,443.1	10,568.2	9,350.3
United States	6,860.0	6,939.0	6,784.0
Total	17,303.1	17,507.2	16,134.2
Communist Countries in Soviet Orbit			
Romania	231.0	231.0	229.0
Russia	2,850.0	2,850.0	2,688.0
Other Communist	100.0	100.0	60.0
Total	3,181.0	3,181.0	2,977.0
WORLD TOTAL	20,484.1	20,688.2	19,111.3

Figures are from reliable industry reports or government sources. Estimates are made where complete reports are lacking. *Includes estimated 6,000 bbl. daily from Naft-i-Shah field not operated by Consortium companies. †Includes estimated 3,500 bbl. daily from Naft Khaneh field, operated by Iraq Government.

Jefferson Gas Processing Specialist helps pick the right chemicals

You may be in the initial planning stages of gas processing facilities. Or, you may be altering an existing dehydration or gas sweetening unit. In either event, selection of the right chemicals is most important. Here, Jefferson's Gas Processing Specialist can help.

He will thoroughly review your proposed processes and expected operating conditions with your engineers. In the removal of water by either glycol absorption or injection, the type unit, nature of the gas stream, degree of dew point depression and hydrate inhibition as well as the properties of the glycols are important in determining the *right* glycol . . . ethylene, diethylene and triethylene glycols or HI-DRY® tetraethylene glycol. Similarly in gas sweetening, the type and composition of the gas stream to be treated and final purity of product are important factors in the proper choice between monoethanolamine and diethanolamine sweetening.

Jefferson's Gas Processing Specialist can also suggest the most economical handling and storage practices for your operation, the best shipping means, and, of course, supply all your glycols and amines in the quantity and purity you need . . . Jefferson Chemical Company, Inc., 1121 Walker Avenue, P. O. Box 303, Houston 1, Texas.

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JEFFERSON CHEMICALS

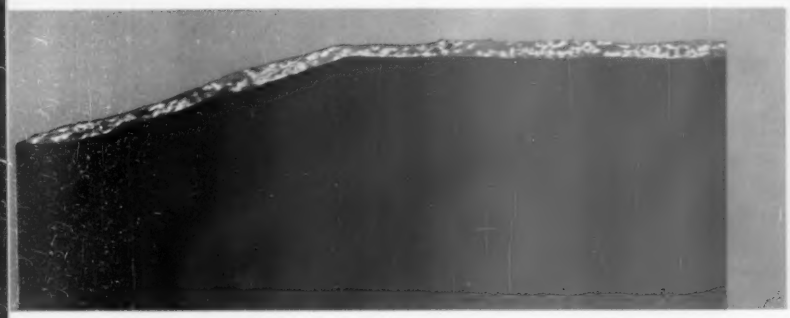
061

HUGHES

hardfacing

doubles – often triples – life of your tool joints

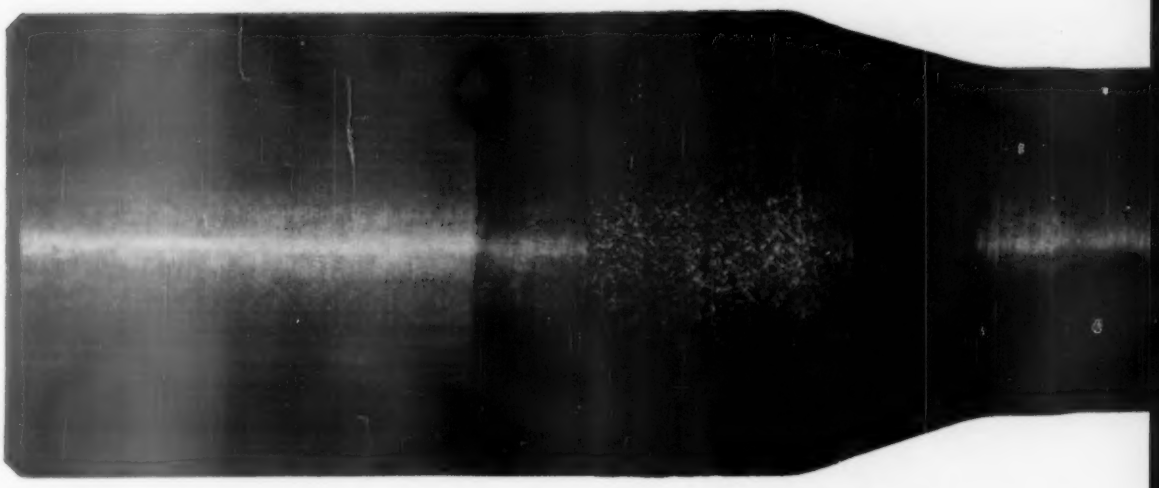
There are three outstanding reasons why Hughes hardfacing gives your tool joints long, superior protection against wear: 1) Quality of the hardfacing material – *Hughesite* – 25 times more wear resistant than hardened steel. 2) Method of application which assures an even distribution of *Hughesite* particles in the hardfaced bands. 3) Inspection of hardfacing to check the bonding of the hardfacing to the parent metal of the tool joint.



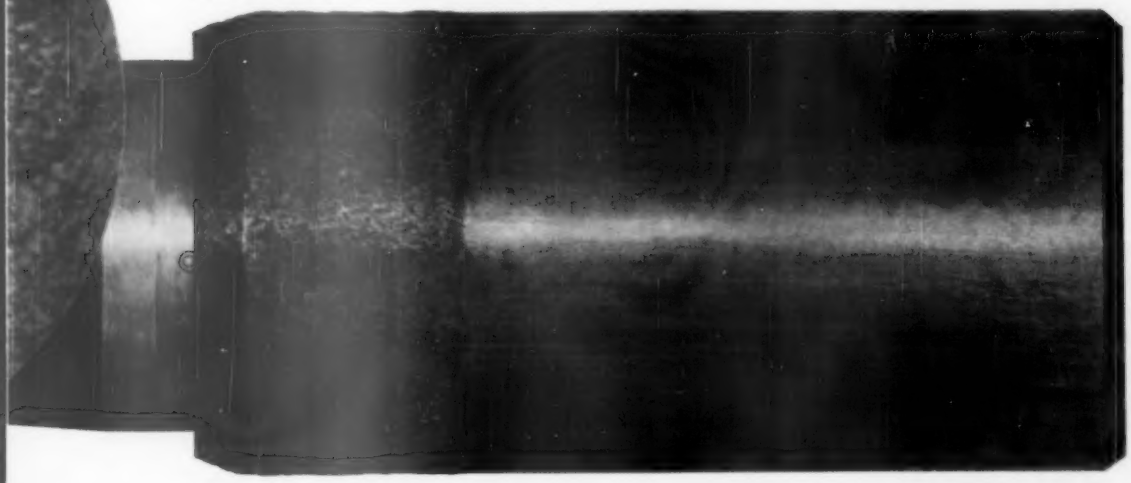
HARDFACING AS SEEN BY METALLURGICAL CAMERA. Large photograph, top, is a photomicrograph of a pinpoint of *Hughesite*, magnified 2,000 times. The cross section of a single band of hardfacing, right – magnified about three times – shows the even distribution of *Hughesite* particles throughout the hardfaced area. This assures uniform wear resistance during life of the hardfacing. The photograph at the left is a section through one of the fingers of hardfacing. These fingers provide continuous hardfacing through the circumferential lands and down the tapered elevator shoulder to provide maximum protection for the lands and elevator shoulder.

Hardfacing in depth was pioneered by Hughes to lengthen tool joint life. Developed and manufactured by Hughes and adapted to tool joint hardfacing, *Hughesite* is a *pure* tungsten carbide, many times harder than the hardest mineral formations encountered in oil well drilling. It is the hardest material that can be successfully used to hardface tool joints. Because of its fine-grained structure (see the color photomicrograph), *Hughesite* possesses the unique combination of hardness and toughness needed to withstand shock and abrasion.

The even distribution of *Hughesite* particles, achieved through the Hughes method of applying the hardfacing, assures *uniform resistance to wear* during the



"FLASH-WELD" tool joints – taper and square shouldered – are hardfaced with three, four or five bands of *Hughesite*. Five are standard on taper shouldered and four bands on square shouldered joints and are recommended where severe wear conditions exist. Fingers of hardfacing extending through the circumferential lands and onto the elevator shoulder on both taper and square shouldered joints, protect against undercutting in these critcial wear areas.

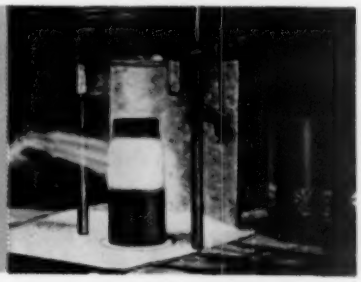


"SEAL-GRIP" tool joints are available with three or four bands of hardfacing. Four bands are standard. Sled runner design and interruption of the guide ribs with hardfacing provide a wear-resistant surface that protects the guide ribs and adjoining surfaces against undercutting.

entire life of the hardfacing. One of the major advantages of Hughes "Flash-Weld" joints is the fact that they may be *safely* re-hardfaced in the field as many times as the life of the drillstem will justify.

The combination of highest quality material, method of application and inspection provides wear resistance that makes Hughes hardfaced joints equivalent to an extra set, and often two sets, of non-hardfaced tool joints . . . at a fraction of their cost.

"SNOW TESTING" is an added and unique Hughes inspection method that serves as a positive check of the bonding of hardfacing material to the parent metal of the tool joint.



HUGHES TOOL COMPANY

DEVELOPERS OF "FLASH-WELD" AND "SEAL-GRIP" TOOL JOINTS

How one operator used D-Gassers to

reduce gas well costs by about $55,000

A Canadian operator — drilling deep gas wells in the Alberta foothills — is using the SWACO D-Gasser to save about $55,000 per well. Here is how he does it:

This operator, who was developing a gas field in the Alberta foothills, was encountering a gas-cutting problem during drilling that increased costs seriously. The problem was high-pressure, low-volume gas accumulations in a shale section above the main pay or between pay zones.

Until this shale section was reached, mud weight of 10 pounds per gallon was carried. When this section was being penetrated, however, severe gas cutting and "blowing" occurred. The gas cutting then persisted in the form of a two to three hour trip gas for the remainder of the well.

Practice before using D-Gasser

The operator circulated until he could build mud weight up to 11-13 pounds per gallon to control the gas cutting. Lost circulation in the pay section frequently occurred with the heavy mud, and a great deal of lost circulation material was often required. The cost of mud materials to control both gas and lost circulation ran $25,000 or more per well.

Initially, it took anywhere from two days to a week to condition the mud, and in one case it was necessary to set casing before drilling could proceed. In addition, several hours of rig time were lost after each trip gunning out the trip gas.

Practice when using D-Gasser

With a D-Gasser installed, the operator merely starts it up when the gas cutting occurs. Occasionally the preventers have to be closed, and the well placed on choke for a few hours. However, the whole job of mud conditioning can be accomplished in less than one day without increasing the mud weight. Moreover, penetration rates and bit life while drilling using the lower weight muds are substantially improved. Total savings in drilling costs amount to approximately $30,000 per well.

To summarize, the operator has found he saves $25,000 or more in mud costs and something like $30,000 in rig time and other drilling costs.

This case is just one of many examples that prove the SWACO D-Gasser is more than just a safety device to be used for wildcat drilling. It makes possible important reductions in overall well costs in any area where gas cutting is a problem. Contact your nearest SWACO representative to find out just how much D-Gassers can reduce your costs. Also ask him how SWACO Clayjectors and D-Sanders can further reduce drilling costs.

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SWACO

Here's a "bread and butter" graphical method of analyzing velocity logs

that has found one field and improved numerous completions in troublesome fields

This method has been used to advantage in a number of wells. Examples included here will show how graphical techniques were used to (1) provide negative data, (2) locate oil in the absence of other positive data, and (3) confirm discovery of oil suggested by other data.

BY C. R. DAVIS
Shell Oil Co., Midland, Tex.

THE INTRODUCTION of acoustic velocity logs, such as Schlumberger Well Surveying Corp.'s Sonic log and Lane Wells Co.'s Acoustilog eliminated some of the problems inherent with the neutron log. Specifically, these two-detector velocity logs are almost free of influence from hole size, drilling mud, sonde position, and the effects of thin beds and surrounding beds.

Unfortunately, acoustic velocity logs cannot be obtained under as wide a range of conditions as neutron logs. And they have their own peculiar deterrents to porosity determinations. Two of these latter factors are the effects on velocity log response due to different lithologies and the effect due to the pressure differential between overburden and reservoir fluid. By combining the velocity log with a good resistivity log, however, most of the adverse effects are reduced.

Porosity determination. Porosities have been found from acoustic velocity logs by correlating with longitudinal wave velocities. The most common formula for this correlation as proposed by Wyllie[1] in the so-called time-average relation:

$$t = \frac{1}{V} = \frac{\phi}{V_f} + \frac{1-\phi}{V_m} \quad (1)$$

Where:

t = interval transit time, microseconds per foot

V = measured velocity, feet per second

V_f = velocity of interstitial liquid, feet per second

V_m = velocity of material constituting the grains of the rock, feet per second

ϕ = fractional porosity

A recorded velocity of 12,000 ft. per second in a clean sandstone (V_m = 18,000 ft. per second) with an average V_f of approximately 5,000 ft. per second would, thus, correspond to a porosity of 19%:

$$\frac{1}{V} = \frac{\phi}{V_f} + \frac{1-\phi}{V_m} \quad (1)$$

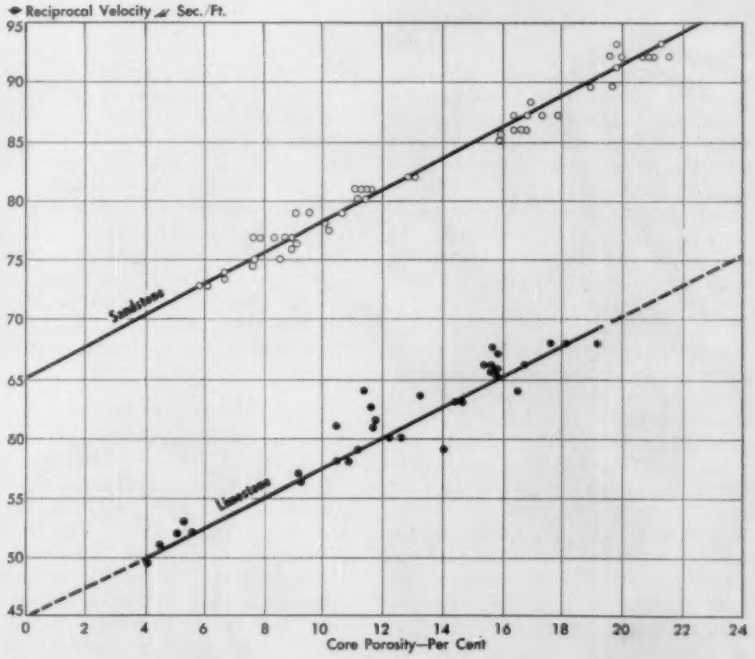
$$\phi = \frac{(1/V - 1/V_m)}{(1/V_f - 1/V_m)} \quad (2)$$

$$\phi = \frac{(1/12{,}000 - 1/18{,}000)}{(1/5{,}000 - 1/18{,}000)}$$

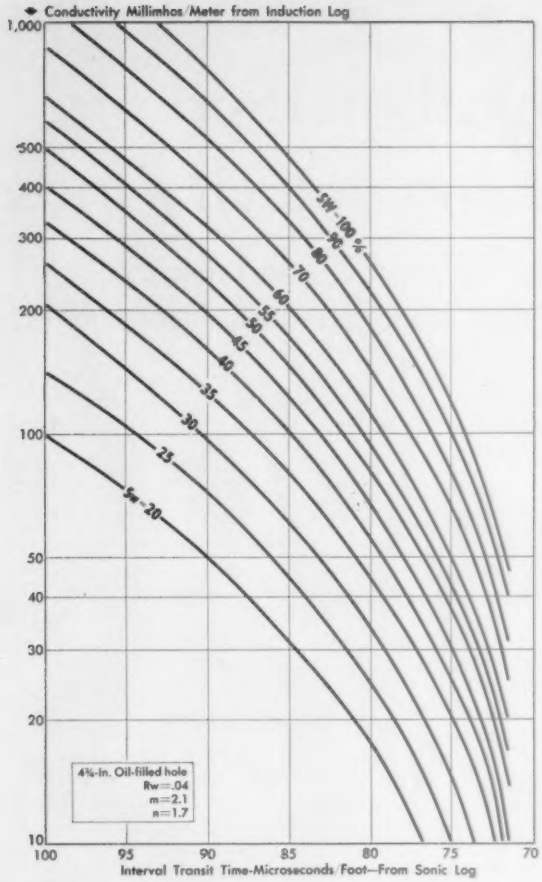
$$\phi = 19\%$$

Graphs have been constructed to simplify the calculation, and average values of V_m for different rock types have been offered for use. In the simplest application, all that is needed to find porosity is knowledge of rock type. From this, an average matrix velocity is chosen and porosity is estimated from a graph.

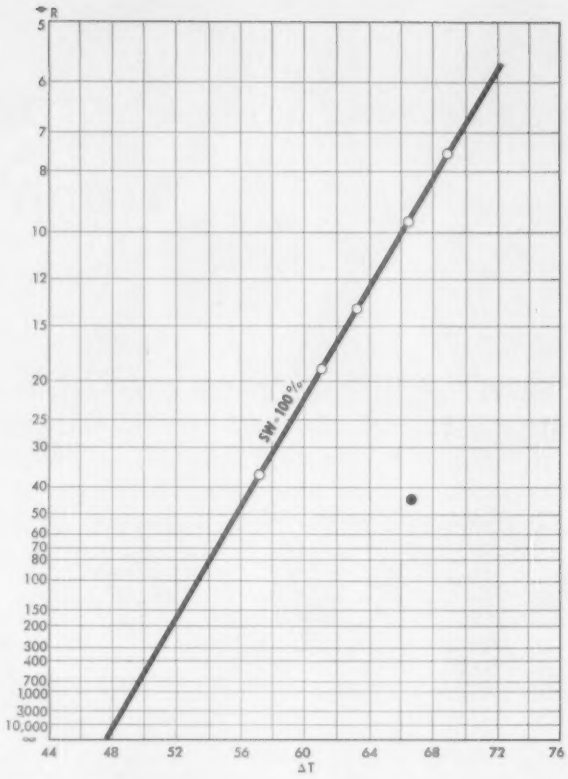
There is evidence suggesting the



VELOCITY LOG RESPONSE is a linear function of porosity, or nearly so, in the porosity range of usual interest, 3 to 30%. Fig. 1.



CONDUCTIVITY vs. interval transit time for Yates sandstone, Scarborough field, shows nonlinear plot. Semi-log coordinates are used. Fig. 2.



SPECIAL COORDINATES make the conductivity-transit time plot linear at constant water saturation. Square root of reciprocal of true resistivity is ordinate. Reciprocal velocity is abscissa. Fig. 3.

time-average equation is inadequate, that acoustic wave velocity is related to things other than rock matrix and liquid velocities. An explanation of the complex acoustic velocity waves will not be attempted here. Instead, a graphical method of using velocity logs is presented, with examples. This method appears to be a good way to use present-day velocity logs when the rock matrix velocity is unknown.

Porosity vs. Velocity

The relationship between acoustic-log response and porosity is linear, or nearly so, in the porosity range of usual interest, say, 3 to 30%. Core porosities have been plotted versus log response in numerous examples published by logging companies. In each case, most of the data are linear. Fig. 1 is typical, illustrating the relationship for a sandstone and a limestone. If the best line through points such as those on Fig. 1 is a straight line, no further proof of linearity is needed.

The limestone core suite in Fig. 1 is from an abandoned wildcat in Upton County, Texas. The sandstone core suite is from Shell-Woodley 9 Scarborough, a Yates sandstone producer in Winkler County, Texas. The matrix velocity in Fig. 1 is only 15,400 ft. per second, a significant variation from the average value of 18,000, sometimes suggested by Schlumberger. If core data had not been available, and the average value had been used to calibrate the logs, the error in porosity would have been at least 5%. This shows the importance of knowing accurately the applicable matrix velocity.

Matrix Velocity

Choosing an average value of matrix velocity is not a good way to interpret a log. A further illustration of the wide range that matrix velocities have, taken from AIME Technical Paper 8063,[2] is shown in Table 1.

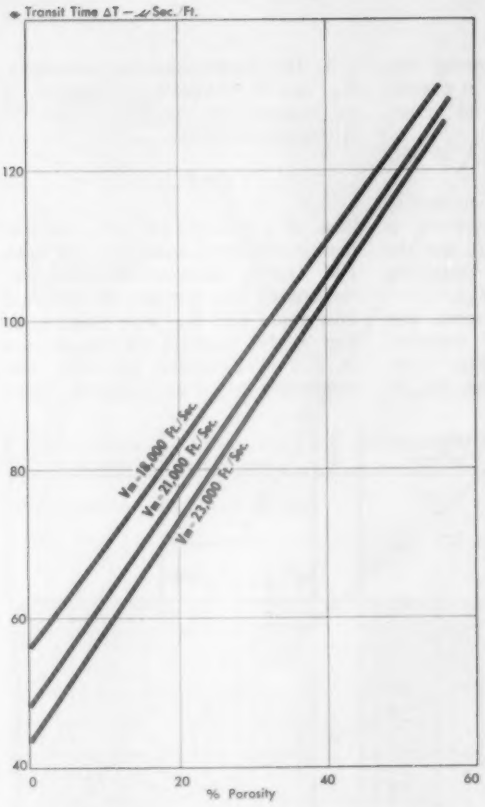
Experimental data by Wyllie and others concerning the relationship between velocity and porosity in sandstones was recently summarized and discussed by Pickett and Talbot.[3] These data suggest that the porosity-velocity relationship is not perfectly linear and that especially in the very low porosity range one should not expect linearity. Thus, the "matrix velocities" obtainable from Fig. 1 by extrapolation of core data to zero porosity, are not true matrix velocities but pseudomatrix velocities, or, "extrapolated matrix velocities." We are faced with the problem, then, of knowing that the proper matrix velocity is of first importance in interpreting a velocity log, and also knowing that we probably cannot find the true matrix velocity by a linear extrapolation of core data.

For most interpretation work, the best solution appears to be the use

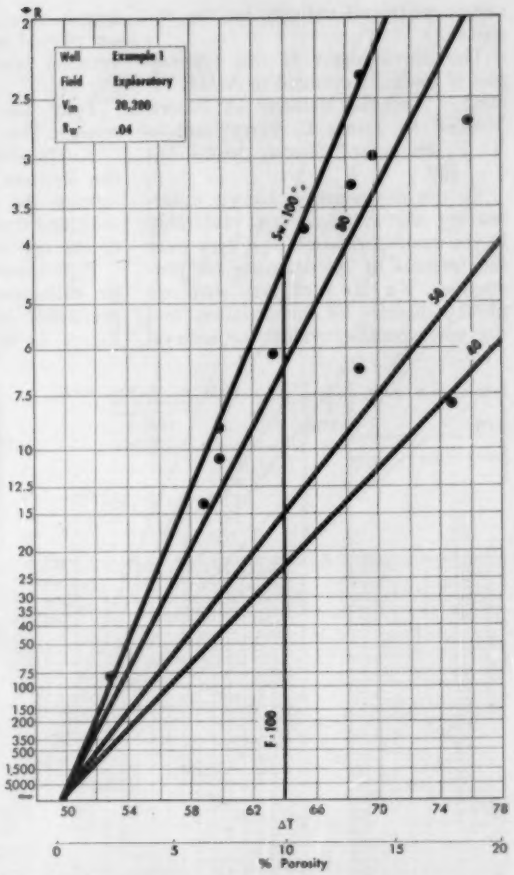
TABLE 1

Values of Typical Sonic Velocities and Corresponding Transit Times for Various Materials

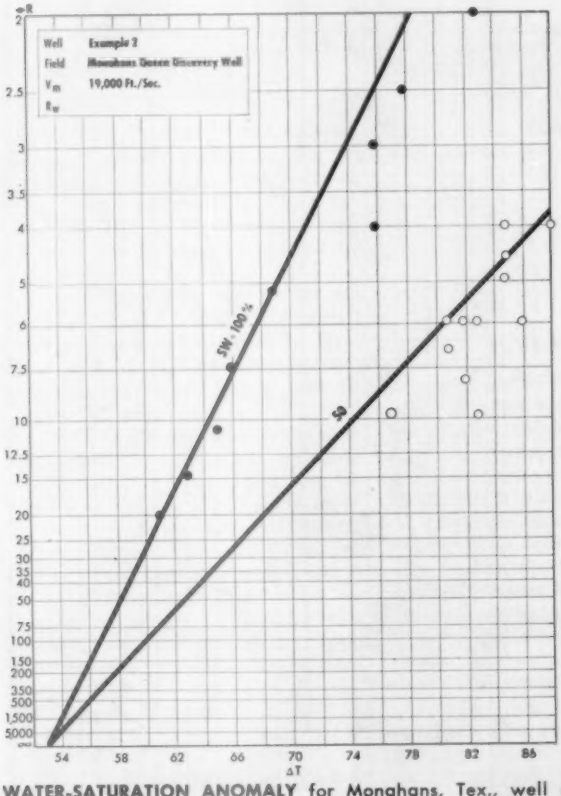
Material	Sonic velocity (ft./sec.)	Transit time (μ sec./ft.)
Oil	4,300	232
Water (mud)	5,000-5,300	200-189
Neoprene	5,300	189
Shales	6,000-16,000	167-62.5
Rock salt	15,000	66.7
Sandstones	Up to 18,000	55.6
Anhydrite	20,000	50.0
Carbonates	21,000-23,000	47.6-43.5
Dolomites	24,000	42



POROSITY CHART for sonic logs shows transit time as a function of per cent porosity. Fig. 4.



VELOCITY-RESISTIVITY plot for Example 1, an exploratory well in Glasscock County, Texas. Ordinate is square root of reciprocal of true resistivity. Fig. 5.



WATER-SATURATION ANOMALY for Monahans, Tex., well of Example 2 was discovered by the graphical method. Ordinate is square root of reciprocal of true resistivity. Fig. 6.

of linear extrapolations of known data. These "extrapolated matrix velocities" can be found from core data and by graphical means. They are convenient and practical to use, and introduce only small error.

Graphical Method

For some years, it has been common to plot the response of radioactivity logs versus the responses of resistivity logs on semilogarithmic paper. Such a plot is convenient in showing changes in water saturation.

With the introduction of acoustic velocity logs, a similar method of analysis was attempted using the velocity log in place of the neutron log. Fig. 2 shows a grid of formation-water saturation lines used by Shell Oil Co. in 1958 for Scarborough field in West Texas. The lines on Fig. 2 are curved, and they were established by known water saturations from cores taken in oil.

Fig. 3 is plotted on a type of graph paper more useful than semilogarithmic paper. This paper is used to plot the square root of the reciprocal of true resistivity on the ordinate

versus reciprocal velocity on the abscissa.

The development of this type of plot is generally credited to AIME TP 8085, "Acoustic Velocity in Porous Media," by James E. Berry; and to A. T. Hingle of Socony Mobil Oil Co., Inc.

To use the paper, a known water-bearing interval is chosen, preferably in the same formation and very near the interval of questionable oil production. Values of resistivity are plotted directly on the ordinate, and the corresponding values of interval transit time, from the velocity log, are plotted on the abscissa. In a water zone, a straight line should result, Fig. 3.

Four uses may be made of this straight line:

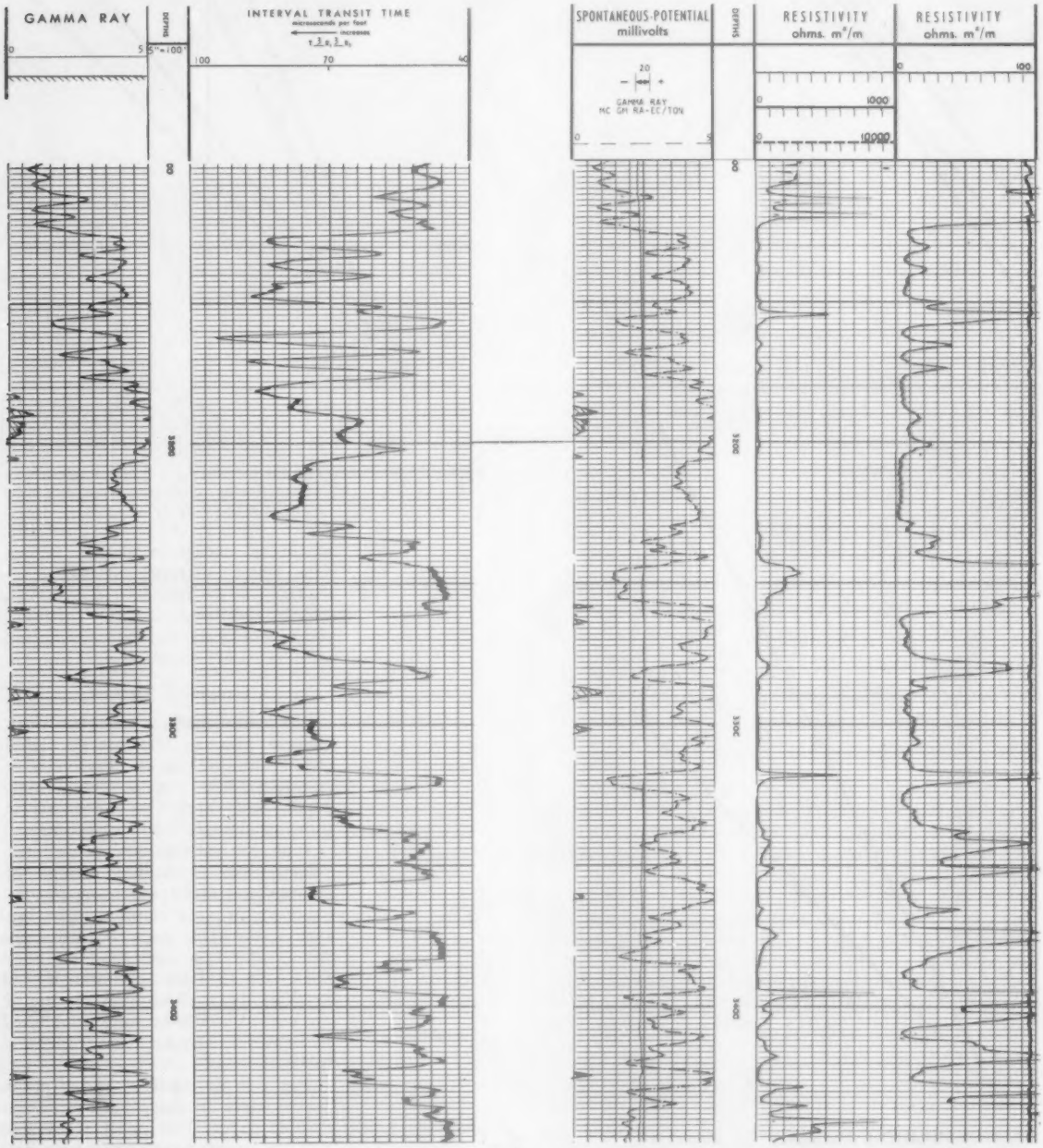
1. The line may be extrapolated to the abscissa where the resistivity is infinite, the porosity is zero, and the indicated transit time is the reciprocal of the matrix velocity ($1/V_m$).

2. Knowing V_m, the abscissa can be calibrated in terms of porosity, preferably by use of empirical data, Fig. 1, or by published data, Fig. 4.

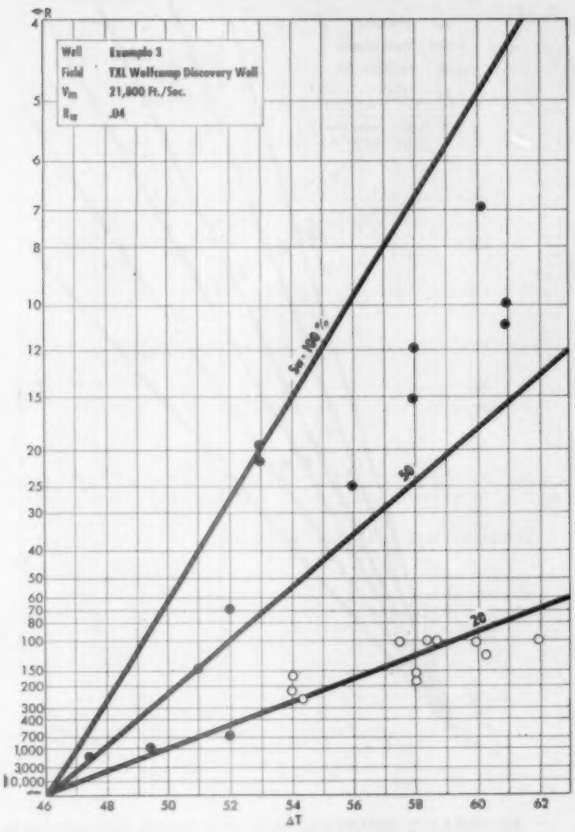
3. The formation-water resistivity, R_w, can be obtained, or checked. If we assume "m" equals 2.0 in the Archie relationship:

$$\phi^m F = 1 \qquad (3)$$

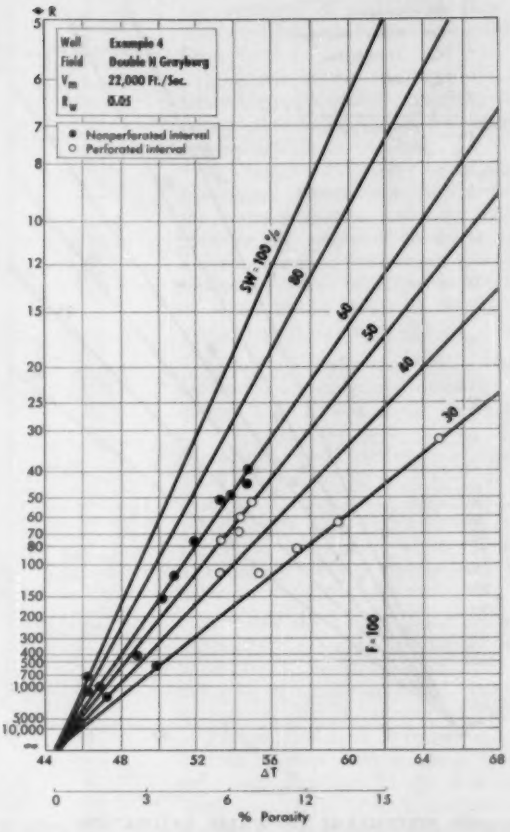
then, at a porosity of 10%, the formation resistivity factor, F, will equal 100. The R_o value on the curve corresponding to a porosity of 10% will thus equal 100 R_w. For example, in Fig. 3, the intercept on the abscissa is 47.5 microseconds per foot, corresponding to an extrapolated matrix



LOG SUITE RUN on Monahans, Tex., well of Example 2. Modern log techniques have enabled the evaluation of the shaly, unconsolidated Queens sand. Fig. 7.



DISCOVERY WELL of TXL Wolfcamp, Example 3, was confirmed by graphical plot. Ordinate is square root of reciprocal of true resistivity. Fig. 8.



REVISED ORDINATE was used in plotting the data of Example 4, a well in the Grayburg dolomite. Core analysis showed value of "m" to be 2.2. Therefore, ordinate is the 2.2 root of the reciprocal of true resistivity. Fig. 9.

velocity of 21,000 ft. per second. Interpolating the curves on Fig. 4 shows that 10% porosity corresponds to a transit time of 61. From the curve on Fig. 3, R_o at transit time 61 is 19 ohm-m. and R_w should be 0.19 ohm-m.

4. A point falling well below the R_o line, such as the filled circle shown on Fig. 3, can be assumed to have some oil saturation because the resistivity is significantly higher than R_o at that porosity.

Lines representing water saturation less than 100% can now be placed on Fig. 3. Each line will intersect the abscissa at the point $1/V_m$; the intersection of each line with the vertical corresponding to 61 microseconds per foot can be determined from Table 2, which is made from Equation 4, assuming "n" equals 1.8 (a value substantiated by core analysis for many West Texas formations):

$$S_w^{-n} = R_t/R_o \qquad (4)$$

Limitations

The graphical method can produce only qualitative values of water saturation if a known water zone is not present and the 100% water-saturation line is not well defined. To avoid uncertainty, the value of formation-water resistivity, found by independent means, should be confirmed by the graph as outlined.

TABLE 2
Calculation of R_t from Equation 4

% SW	n	Resistivity ratio	R_t at 10% porosity (ohm-m.)
100	1.8	1.0	19
80	1.8	1.5	28.5
60	1.8	2.5	47.5
50	1.8	3.5	66.5
40	1.8	5.2	98.8
30	1.8	8.7	165.3

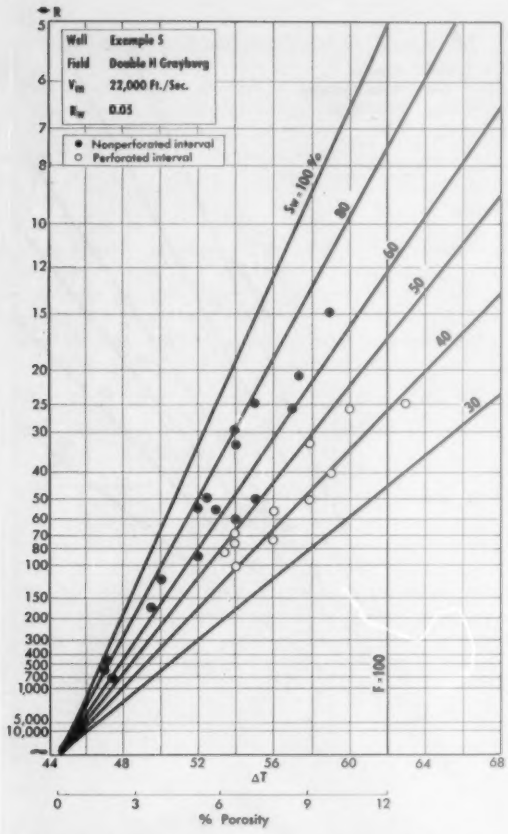
A serious limitation of the graphical method is its restriction to a uniform rock type. If the rock type varies appreciably within the zone of interest, acoustical properties will vary within that zone. Besides this, the method is limited to the same restrictive conditions that generally limit the use of the velocity log, including free gas in the formation and vuggy rock. Free gas may cause an erratic velocity log; vuggy rock is generally recorded as low porosity by the velocity log. Application of this method to a vuggy zone thereby might result in high values of formation-water saturation.

Examples

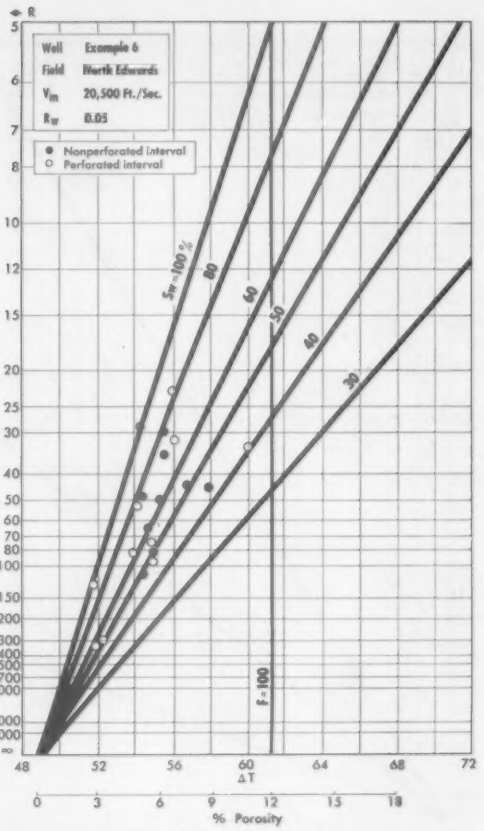
The first and most important purpose of log interpretation is to locate oil and gas-bearing zones. To do this, the interpreter is searching for an anomaly rather than an absolute value of porosity or water saturation. Wyllie has expressed this same thought more eloquently:

"There is a prevalent fetish that log interpretation is 'good' only if it produces result in terms of X per cent porosity and Y per cent water saturation. These are the terms of the reserves engineer. Log interpretation in the exploration phase is good if it leads to no oil or gas sands being missed, bad if it does. When the extent, permeability, and producing mechanism of a reservoir are all unknown, it is academic to strive for the precise calculation of porosity and saturation."[4]

The first three examples that follow are taken from exploratory wells. These show how the graphical method was used in West Texas to (1) provide negative data, (2) locate oil in the



HIGHER PERCENTAGE OF WATER SATURATION was indicated for the second well in Grayburg dolomite, Example 5. Value of "m" used in the correlation was 2.2. Fig. 10.



PERFORATED INTERVALS of well in North Edwards field, Example 6, include some wells of high-water saturation. Value of "m" for correlation is 2.2. Fig. 11.

absence of other positive data, (3) confirm the discovery of oil suggested by other data. The last three examples are taken from an established oil field and show how this method can help isolate water zones present in the gross oil column.

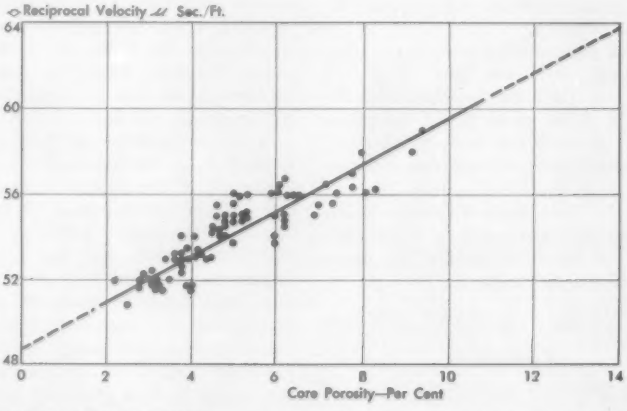
Example 1. On a recent Glasscock County, Texas, exploratory well, oil shows were found in samples from the Clear Fork formation in the interval 2,790-2,920 ft. An 11-in. bit was used at this depth, and the hole was badly caved so the sonic log was used for porosity in preference to a neutron log. A formation test recovered too little fluid to be diagnostic, and logs were run immediately after penetrating the hydrocarbon-bearing interval so that no known water-bearing zone was present below the zone of interest.

Uncorrected log values were plotted directly on the graph, Fig. 5. As this well was logged only a few hours after the Clear Fork section was drilled, no correction was made for invasion. Four points were used to establish the R_o line, and the matrix velocity, 20,200 ft. per second. Formation-water resistivity calculated from the spontaneous-potential curve was 0.04 ohm-m. This value was nearly confirmed by the graphical plot: R_o at 10% porosity was 4.3 ohm-m. and R_w was therefore 0.043 ohm-m.

Only one 4-ft. zone was shown to be of less than 50% water saturation, so no attempt was made to complete the well in this formation.

Example 2. This one concerns a unique set of conditions and is a good illustration for the usefulness of the subject interpretation method. The formation is the shallow radioactive Queen sandstone near Monahans, Tex.

Fig. 7 shows the log suite run in this well. Before 1960, the Queen sand was never properly evaluated in this area because: (1) most of the wells were drilled before short-spacing velocity logs and focused resistivity logs were available, (2) the sand is shaly and nearly unconsolidated so that oil shows were not found in rotary drill-



WHOLE CORE POROSITY as function of reciprocal velocity for North Edwards well of Example 6. Fig. 12.

TABLE 3—RESULTS FOR EXAMPLE 4

Point	Depth (ft.)	Laterolog value (ohm-m.)	Sonic-log value (microseconds per foot)	Water saturation from Fig. 9 (per cent)
1	4,525-30	33	65	30
2	4,519-21	1,500	46.5	75
3	4,503-05	1,100	47	60
4	4,494-99	530	50	31
5	4,485-90	40	55	60
6	4,479-85	45	55	57
7	4,472-76	60	54.5	49
8	4,464-70	75	53.5	50
9	4,436-41	52	53.5	62
10	4,428-32	780	46.5	100
11	4,418-28	450	49	45
12	4,402-14	50	54	60
13	4,384-92	120	51	60
14	4,372-75	2,000	47.5	40
15	4,364-70	52	55	50
16	4,343-49	160	50.5	50
17	4,335-39	78	52	62
18	4,318-22	70	54.5	46
19	4,312-16	120	55.5	32
20	4,303-11	85	57.5	31
21	4,294-98	65	59.5	30
22	4,275-86	110	53.5	42

TABLE 4—RESULTS FOR EXAMPLE 5

Point	Depth (ft.)	Laterolog value (ohm-m.)	Sonic-log value (microseconds per foot)	Water saturation from Fig. 10 (per cent)
1	4,650	90	52	59
2	4,642-45	180	49.5	70
3	4,636-40	70	54	49
4	4,634-36	74	56	38
5	4,631-33	57	56	44
6	4,620-25	120	50	78
7	4,612-16	25	63	38
8	4,593-96	50	58	38
9	4,584-87	600	47	85
10	4,580-84	700	47.5	65
11	4,575-80	475	47	98
12	4,550-57	25	55	79
13	4,546-50	72	54	48
14	4,543-46	33	54	78
15	4,535-42	50	52.5	76
16	4,517-20	26	57	61
17	4,500-04	30	54	80
18	4,448-52	26	60	46
19	4,418-22	53	52	79
20	4,380-86	15	59	70
21	4,374-80	50	55	53
22	4,369-74	32	58	90
23	4,360-64	85	53.5	48
24	4,354-59	40	59	39
25	4,350-54	100	54	41
26	4,344-50	22	57.5	68
27	4,341-44	60	54	55
28	4,332-37	55	53	65

TABLE 5—RESULTS FOR EXAMPLE 6

Point	Depth (ft.)	Laterolog value (ohm-m.)	Sonic-log value (microseconds per foot)	Water saturation from Fig. 11 (per cent)
1	4,518-25	1,000	50.5	70
2	4,506-13	28	54.5	100
3	4,489-99	35	55.5	75
4	4,493-97	30	55.5	80
5	4,466-70	65	55	60
6	4,454-60	125	52	100
7	4,450-53	333	52	55
8	4,442-50	85	54	64
9	4,425-30	35	60	40
10	4,410-14	85	55	50
11	4,405-10	45	57	51
12	4,400-05	49	54.5	76
13	4,375-80	52	54.3	77
14	4,368-72	32	56	72
15	4,364-72	300	52.5	48
16	4,359-64	23	56	90
17	4,343-46	75	55	54
18	4,334-38	45	58	45
19	4,322-28	50	55.5	62
20	4,316-20	120	54.5	49
21	4,310-14	90	55	48

ing cuttings, (3) the sand must be fracture-treated before it will produce fluid.

With the advent of the sonic log-Laterolog combination, modern fracturing techniques, and the subject graphical-analysis method, the tools were finally available to discover Monahans Queen field. Fig. 6 shows the water-saturation anomaly discovered by the graphical method. After a water-fracture treatment, this well flowed 199 bbl. of oil with 326 bbl. of water in 24 hours on initial potential test in January 1960.

Example 3. Here is a striking water-saturation anomaly in a dolomite reservoir. Fig. 8 was made from logs on the discovery well of the TXL Wolfcamp. This formation yielded a small amount of oil on drill-stem test and the discovery was confirmed by the graphical plot. This well was completed in December 1959, flowing 184 bbl. of oil per day with 2 bbl. of water.

Example 4. This is taken from a field where a known formation-water resistivity value is used to establish the grid of saturation lines. The formation is the Grayburg dolomite, which contains sand, gypsum, and anhydrite as thin stringers and as disseminated minerals in the dolomite. Numerous thin porous streaks are present with apparently a random distribution of oil and water zones. The variety of minerals present often causes an apparent shift of matrix velocity on graphical plots; yet, the use of velocity versus resistivity plots has been the most successful method to date of separating oil zones from water zones.

For this type of rock, an "m" value of 2.2 has been found from core analysis, so graph paper was constructed accordingly. Table 3 presents values of sonic-log response and Laterolog response which were plotted on Fig. 9.

After the points were plotted, the R_o line was placed on the paper using the lowest sonic-log response values and a known formation-water resistivity. No correction was made for the effects of invasion on the Laterolog, but it was recognized that such corrections would tend to lower the water-saturation values depicted by the graph. All zones with **apparent** water saturations of 50% or less, and porosities 5% or greater, were perforated, as shown by the open circles on Fig. 9. This well flowed 238 bbl. per day of oil with 3% water cut on the initial potential test.

Example 5. Here is the second well in the area, drilled downstructure from the well in Example 4. Graphical analysis was handled the same as above. Table 4 presents the values of sonic-

log response and Laterolog response. Perforation intervals were chosen by the same method as above and the graph was then compared with Fig. 9. Fig. 10 revealed a higher average water saturation than Fig. 9, and this led to the prediction of slightly higher water production upon completion. This well was completed flowing 144 bbl. oil per day with 14% water cut.

Example 6. This well was actually the first of the three wells (Examples 4, 5, and 6) to be completed in the same Grayburg dolomite. A core was taken in the productive section and analyzed by a commercial laboratory. Fig. 12 is the plot of whole core porosity versus sonic-log response. A graphical analysis of the logs was made similar to that above. In this case, the extrapolated matrix velocity was known from the relationship of Fig. 11, and formation-water resistivity was known from nearby produced water, so the R_o line was well established. Log values are tabulated on Table 5 and plotted on Fig. 11. In spite of the adequate core and log data available, perforation intervals were chosen without the benefit of any quantitative log analysis. As shown on Fig. 11, the perforated intervals include some zones of high water saturation while several attractive zones were not opened. This well was tested for 30 bbl. per day oil and 150 bbl. per day water. The graphical-analysis method would probably have effected a better completion here, in view of the similarity of this well with the two wells discussed above. This example illustrates that there was a genuine danger of high water production in the two previously discussed wells, had not some effective means been devised to delineate the water productive zones.

Conclusions

The subject method of plotting an acoustic velocity log versus a focused resistivity log is one of the interpretation advances that has resulted in the discovery of new oil fields and new oil zones in old producing fields. Nomographs and charts and empirical correlations are often scorned by good interpretation men, and for good reason, but the method shown here has many aspects worth considering:

1. The method is independent of porosity. As long as velocity-log response to porosity is nearly linear, water saturations can be estimated even if no attempt is made to estimate porosity.

2. In an uncored well, where the value of extrapolated matrix velocity is unknown, it can be determined graphically.

3. If a part of the formation being analyzed is known to be water bearing, the graphical method does not require prior knowledge of formation-water resistivity. Conversely, if formation-water resistivity is known, a water-bearing zone need not be present. If neither is available, the interpretation may still be made qualitatively, and a zone of oil saturation will appear as an anomaly.

4. The graph tends to eliminate errors in sonde calibration. If different velocity log sondes are run in a given well, and the respective logs show a uniform response difference, a different extrapolated matrix velocity is obtained, but water-saturation values are identical.

5. In exploratory wells in coastal regions many thousands of feet of shale can often be eliminated from further evaluation by a cursory glance at the logs. In limestone country an exploratory well may penetrate carbonate beds throughout, and a careful examination of some thousands of feet of carbonate section, foot by foot, is a tedious task indeed. The graphical plot of log responses is a rapid way of evaluating thick formations.

6. The log interpreter has fulfilled a large part of his responsibility if he never overlooks a single hydrocarbon-productive zone. The graphical method's best use is to separate zones with hydrocarbons from zones without.

Further uses can be made of the graph than have been suggested in this study; Schlumberger has suggested plotting two values of resistivity for each transit time; one from a shallow investigating device, the other from a deep investigating device. With a fresh mud-filtrate, this method will establish the maximum resistivity line that can be attributed to mud-filtrate invasion. Resistivities greater than this must result, then, from hydrocarbons. Further embellishments suggest themselves readily, but care should be taken that an excellent qualitative method not be metamorphosed into a mediocre quantitative one.

References

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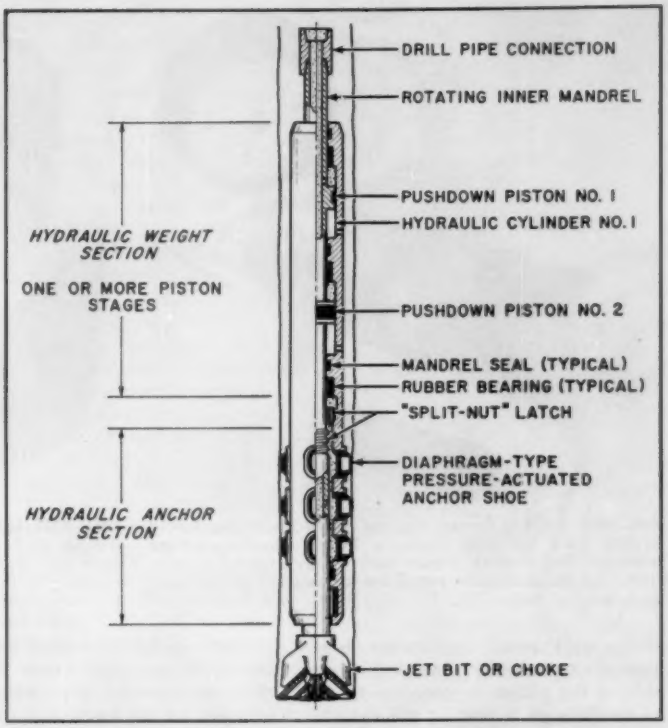
4. M. R. J. Wyllie, "Log Interpretation in Sandstone Reservoirs": Paper presented at the twenty-ninth annual international meeting, Society of Exploration Geophysicists, Los Angeles, Nov. 9-12, 1959.

First HF Unit is now operating at British American Oil's Clarkson refinery, 20 miles west of Toronto. The $3,000,000, 3,000-bbl.-a-day unit is comprised of a feed-preparation system, two fractionating columns, acid contactors, and a 154-ft. isostripper tower. General contractor for the installation was Procon (Canada) Ltd.

DRILL COLLAR is composed of two basic sections. Hydraulic-weight section puts force on bit as result of pressure drop in mud system. Anchor system prevents upthrust from reaching drill pipe above. Fig. 1.



ADDING A SECOND PISTON, or even a third, provides extra weight on bit when one piston isn't enough. Number of anchors determines how much upthrust can be anchored against the walls of the hole. Prototype tool has 6-in. diameter and is 37 ft. long. Fig. 2.

Hydraulic wall-anchored drill collar promises lower drilling costs

BY J. M. KELLNER AND A. P. ROBERTS,
Jersey Production Research Co.,
Tulsa

A NEW DOWNHOLE tool which can put a normal drilling load on a rock bit without use of drill collars has been developed by Jersey Production Research Co.

Instead of dead weight, the new tool loads the bit by means of the pressure drop across a jet bit. The uphole thrust which results from this pressure drop is anchored against the walls of the hole. Although the prototype tool is only 6 in. in diameter and 37 ft. long, it can put the same force on the bit as a long string of collars. None of the upthrust is carried by the drill pipe.

Because of these features, the new "wall-anchored, hydraulic drill collar" has these advantages:

1. It can drill surface hole cheaper in areas where not enough drill collars can be put into the hole to load the bit effectively.

Taken from a paper given at 1960 ASME Petroleum-Mechanical Conference, New Orleans.

2. It takes much less handling time than a regular drill-collar string.

3. Less hoisting power is required than with regular drill collars. Thus, the same rig can drill deeper with the new tool than with regular collars.

4. The new tool costs less to buy than a string of regular collars.

The tool has not yet been tested in enough field wells to be certain, but there may be other advantages such as:

1. Bit life may be lengthened or it may be possible to carry more weight on the bits as a result of the hydraulic shock-absorbing action of the tool.

2. There may be less tendency for crooked hole even though bit weights are high.

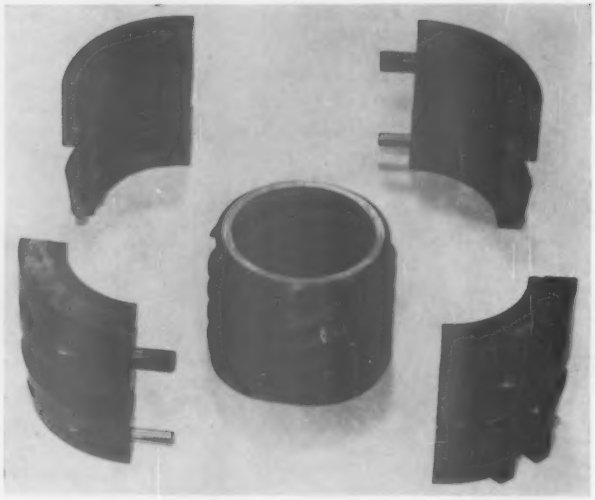
The new tool has already been used to drill 500 ft. of hard rock in a West Texas well. In addition, it has been thoroughly tested in a number of shallow test holes. These tests show that the high loads may be anchored in competent formations, thus eliminating the need for long strings of drill collars.

The hydraulic wall-anchored drill collar has two major sections: the pushdown section and the anchor section, plus a retaining latch. Fig. 1 is a picture of the tool partially disassembled. Fig. 2 is a schematic drawing.

Hydraulic weight section. The pushdown section has one or more single-acting hydraulic cylinders staged in series. The bit load or "weight" is a result of the differential pressure on the pistons within the cylinder.

Each piston is attached to a hollow rotating inner mandrel. This mandrel, in turn, is attached at its upper end to the drill pipe and at its lower end

ANCHOR SHOE is forced against the walls of the newly drilled hole by mud pressure inside diaphragm-type pistons. The shoe is shown here in an expanded position. Tungsten-carbide cylinders, embedded in the core, grip wall of hole. Fig. 3.



SPLIT-NUT RETAINING LATCH prevents the outer case of the hydraulic drill collar from moving up the hole until it is firmly anchored against the hole walls. Once the tool is anchored, rotating to the right disengages split nut for drilling. Fig. 4.

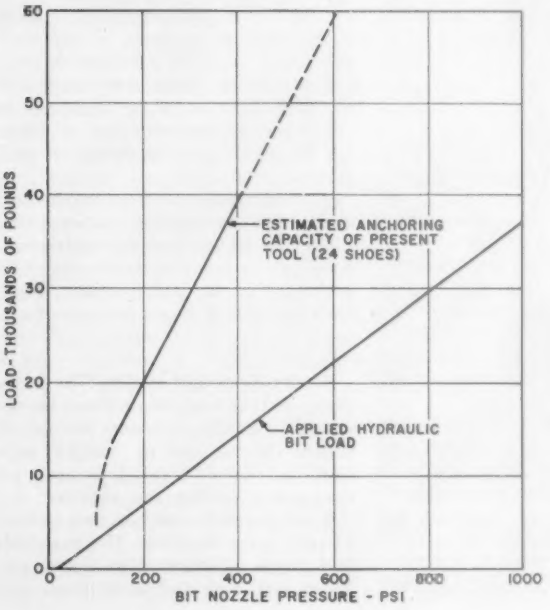
to the bit. Pressure reaches the pistons through a port in the mandrel. Lower side of the piston is vented to the annulus through a port in the cylinder.

The pistons and the inner mandrel rotate within the cylinders, which are held stationary. Both mandrel and piston are supported by rubber bearings to reduce mandrel deflection; this arrangement lengthens seal life and decreases mandrel fatigue failures.

Anchor section. This portion of the tool controls the upward thrust and centers the tool in the hole. To do this, it uses diaphragm-type pistons, called anchor shoes, which are expanded against the wall of the hole by bit-nozzle pressure. These anchor shoes are mounted in an anchor sleeve attached to the lower end of the cylinder section. Pressure reaches the anchor shoes through a port in the mandrel. Rubber bearings in this section reduce mandrel deflection.

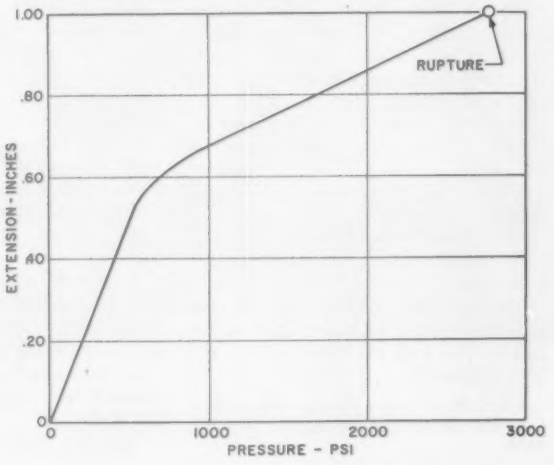
Fig. 3 shows the anchor shoe in an expanded position. The shoe consists of a metal outer sleeve and a metal inner core, as pictured beside the expanded shoe. Rubber is molded in the slot between the core and the sleeve and bonded to each piece. A heavy rubber lip is bonded to the outer sleeve to seal the shoe in the anchor sleeve. Tungsten carbide cylinders, embedded in the core, provide positive wall grip.

Split-nut latch. In addition to the pushdown and anchor sections, the tool contains a "split-nut" retaining latch (Fig. 4). This device locks the outer case, composed of the anchor sleeve and the cylinders, to the inner mandrel when the pushdown pistons are in the upper position within their cylinders. As pressure is applied simultaneously to pushdown pistons and anchor shoes, the latch prevents upward movement of the outer case until it is firmly anchored.



PLENTY of anchoring capacity is provided by the shoes for any load that might be put on the bit by the hydraulic weight section of the tool. Fig. 5.

UP TO 1-IN. overgage hole can be tolerated by the tool before the wall anchors fail to hold. Fig. 6.



The latch is engaged by pulling the male member through the split nut, which is mounted in the anchor sleeve. It is disengaged by rotating the string to the right after the tool is anchored.

Sequence of operation. Here is how a typical run might be conducted:

1. The tool is run to bottom, with the mandrel in the upper end of its stroke. In this position the outer case is locked to the mandrel by the latch.
2. Circulation is started to produce enough pressure drop (400-700 psi.) across the bit to set the anchor shoes.
3. The drill string is turned to the right to unlock the latch. Circulation rate is then increased to apply the desired force to the bit.
4. The drill string then advances as drilling continues for a length of the mandrel stroke (this is governed by the length each piston can travel within its cylinder).
5. At the end of the stroke, rotation of the drill string stops, pressure drop across the bit is reduced to 200-300 psi., and the mandrel is returned to its position. At this reduced pressure, the shoes remain anchored while the hoisting pull is reduced. At the top of the mandrel stroke, the latch locks the case to the inner mandrel.
6. The pump pressure is then reduced to zero, the tool is returned to the bottom of the hole, and the sequence is repeated.

To use all bit force available, the drill pipe is held at its recorded weight while drilling. This places the neutral point of the drill string at the top of the tool. To use only a portion of the tool's output, the hook load is increased above the weight of the drill string alone. For example, if the tool is putting 50,000 lb. weight on the bit and you want only 30,000 lb., increase hook load 20,000 lb.

Size, capacity. The prototype tool was designed for 6¾-in. hole. It is 6 in. in diameter, 37 ft. long, weighs about 2,200 lb., and has a 2-ft. drilling stroke. It is capable of exerting about 40,000 lb. force at the bit, using a pressure drop across the bit of 1,000 psi.

The anchor section contains 24 anchor shoes placed at 8 levels along the anchor sleeve. Each row contains three shoes, 120° apart. They are contained in the sleeve so that the initial shoe extension to gage is ⅛ in. Additional extension is available to compensate for hole enlargement.

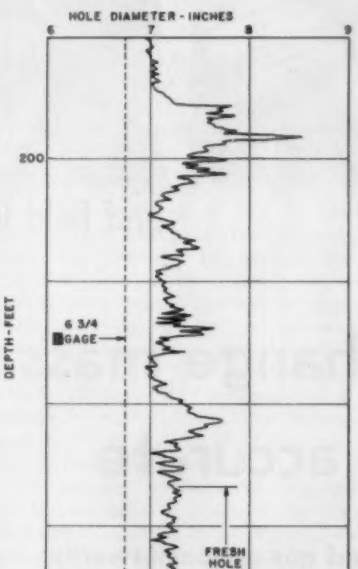
Anchor tests. Initial tests were to determine anchoring capacity of the tool at shallow depths. Later work was to develop high-pressure anchor shoes and to test the tool in shallow drilling at jet bit pressures.

The anchor tests showed that both high thrust and torsional loads can be anchored in an open hole. The effect of both water and high-viscosity muds was tested. High mud viscosity caused no increase of anchor slippage.

These tests were conducted in soft laminated shale and sandstone formations instead of in the harder formations for which the tool was designed. Still, results were exceptionally good. Each shoe was found to be capable of anchoring more thrust than it could safely carry for long periods of time. For this reason, the number of shoes used in the tool was based on safe shoe thrust load rather than on anchoring capacity. Fig. 5 shows estimated anchoring capacity of the tool to be well above the maximum loads to be anchored.

High-pressure shoe. After first tests, we decided to develop a high-pressure anchor shoe. In static pressure tests of the prototype, it withstood 2,750 psi. before failing. Thus, because of the properties of rubber used, the shoe would have a working pressure of at least 1,250 psi. More calculation predicted that each shoe should safely support a vertical thrust load of about 1,500 lb.

Because of the extension characteristics, of the high-pressure shoe, the present tool can tolerate a hole 1 in. overgage before it fails to anchor. Fig. 6 is the pressure-extension curve for a typical anchor shoe.



HOLE isn't badly overgage immediately after drilling, this and other caliper surveys show. Enlargement comes later. Thus, hole just above the bit where anchor shoes fall should always be close enough to gage for a secure seat. Fig. 7.

Shallow drilling tests. A series of shallow tests has been made using a 1,000-psi. pressure drop across the bit. These tests showed that:

1. Seal life is good—100-hour minimum.
2. Anchor shoe life is reasonable—65 hours.
3. Hole enlargement should not be a critical problem.

These conclusions were made after drilling 2,300 ft. of shallow hole in 275 rotating hours to depth of 700 ft. Water was the circulating fluid. Formations varied from laminated shales and sandstone to medium-hard limestones.

The seals were routinely changed after about 100 hours of operation, although they appeared to be in excellent condition.

Fig. 7 is a caliper survey of a hole freshly drilled through the softer shales. This survey shows the tool was anchoring satisfactorily in a ½-in.-overgage hole. After several days of circulating, the hole became enlarged, as shown above the freshly drilled section in Fig. 7. The great enlargement shown at 195 ft. (in a coal streak) indicates the tool can drill through such formations without anchoring failure. Caliper surveys in West Texas, including some hole through the red-bed formations, showed similar results. This fact indicates that most hole enlargement usually occurs at least 50 to 100 ft. above the bit.

Economics. It appears that the tool becomes economic if the life of the seals, anchor shoes, etc., is greater than 100 hours. This estimate is based on savings in trip time and drill-collar maintenance, as compared to cost of replacement parts. Resetting-time loss was not considered since it represents little of the drilling time in hard formations. Also, this time loss could be reduced by increasing length of stroke.

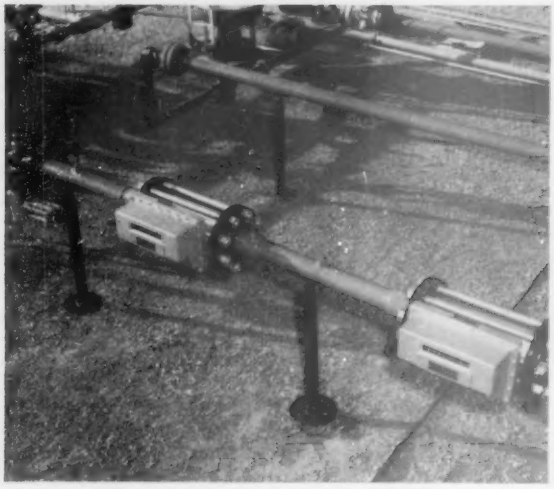
Initial investment costs were not considered. Since a hydraulic wall-anchored drill collar should cost 50 to 70% less than drill collars required to give equivalent bit weight, the initial savings appear very good.

Acknowledgments

The authors express their appreciation to J. M. Camp, of Jersey Production Research Co., for his aid in designing and testing this tool, and to the staff of Drilco Oil Tools, Inc., for their aid.

Prover setup...

calibration runs...



repeatability tests...

and field tests show that...

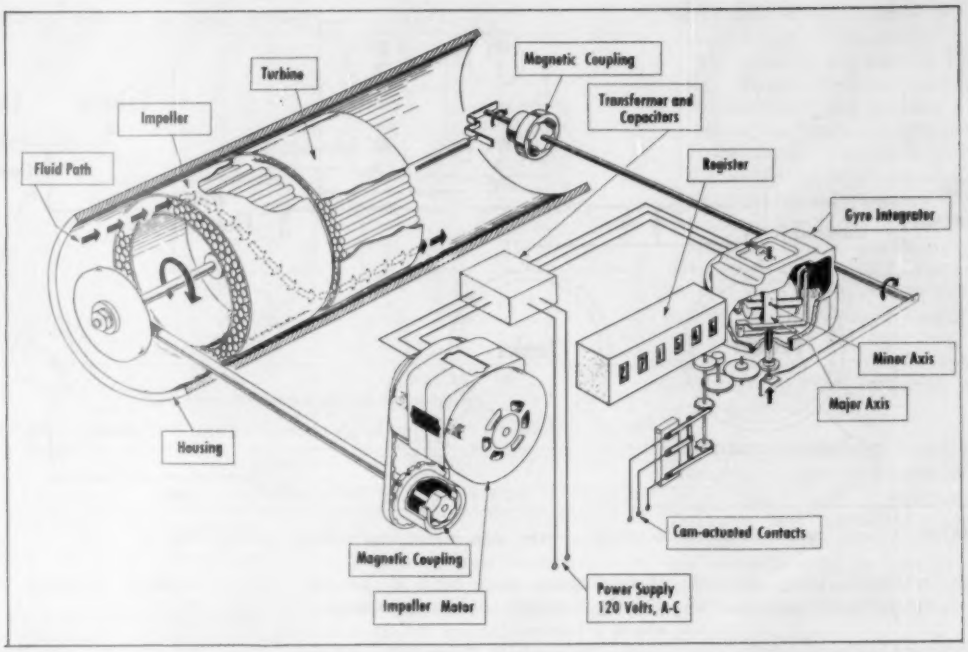
Momentum-change mass flowmeter is practical and accurate

Test installations by nine oil and gas companies verify the dependability of the meter under a variety of field conditions in the measurement of gas. Simplicity of method and of meter make this technique attractive.

BY G. L. FARRAR
Engineering Editor

MASS-FLOW measurement of gas has long been attractive in principle because heat energy in a pound of natural gas varies much less with composition change than does heat energy on a cubic-foot basis. And plant material balances are made on a mass basis.

The stumbling block to mass-flow measurement has been lack of a suitable meter. This has sparked develop-



PRINCIPLE OF OPERATION of momentum-change mass flowmeter is conversion of angular momentum to torque. Fig. 1.

ment work on a number of different measurement devices by several different companies. Results are now available on the momentum - change mass flowmeter, developed jointly by Black, Sivalls & Bryson, Inc., and General Electric Co.

This meter is a "true mass flowmeter," in that the meter basically senses mass flow using a single primary element. This contrasts with the inferential mass flowmeter which basically measures volume and uses other devices to measure other physical properties. These measurements enable the calculation of mass flow.

Output of the momentum - change mass flowmeter is independent, within design limits, of the variable physical properties of the flowing stream.

The momentum-change mass flowmeter has survived a rugged development program. All components were designed, tested, and installed with field use in mind. Then each prototype meter had to pass a calibration test on an absolute prover. Finally, nine of the prototypes have been field tested under a variety of conditions by nine oil and gas companies.

Bugs were found in every stage of development, and changes in design and manufacture were made to eliminate them.

Meters in service. Two of the prototype meters have been purchased by the companies which field tested them. In addition, 13 more meters, all production models, have been purchased for gas service.

About half of the 15 are in ethylene service. This is high-cost material. Measurement needs to be done accurately. And ethylene is hard to meter because it is near the critical in most transfer operations. For example, in going from 600 to 700 psi. at 60° F., specific volume varies from 0.22 to 0.16 $ft.^3/lb.$

Measurement of butadiene is also very difficult. Much interest has been shown in this application.

How it works. A functional diagram of the momentum-change mass flowmeter is shown in Fig. 1. The flowing fluid enters the meter housing and passes through the tubes of the impeller. The impeller, driven by a synchronous motor through a magnetic coupling, moves at constant speed, thus imparting a constant angular velocity to the fluid. The gas then passes through the turbine, downstream of the impeller. The turbine does not turn, and the fluid flow pattern is thus straightened out.

The angular momentum imparted by the impeller is removed by the turbine. This imposes a torque proportional to the mass-flow rate on the turbine. (For complete development of the theory of this proportionality, see Reference 1.) This torque is transmitted through linkage and magnetic coupling to the minor axis of a two-element gyroscope.

The gyroscope then precesses or rotates about its major axis at a rate proportional to the torque.[1] This rotation is transmitted to a counter through a gear train. The counter registers total mass of fluid which has passed through the meter.

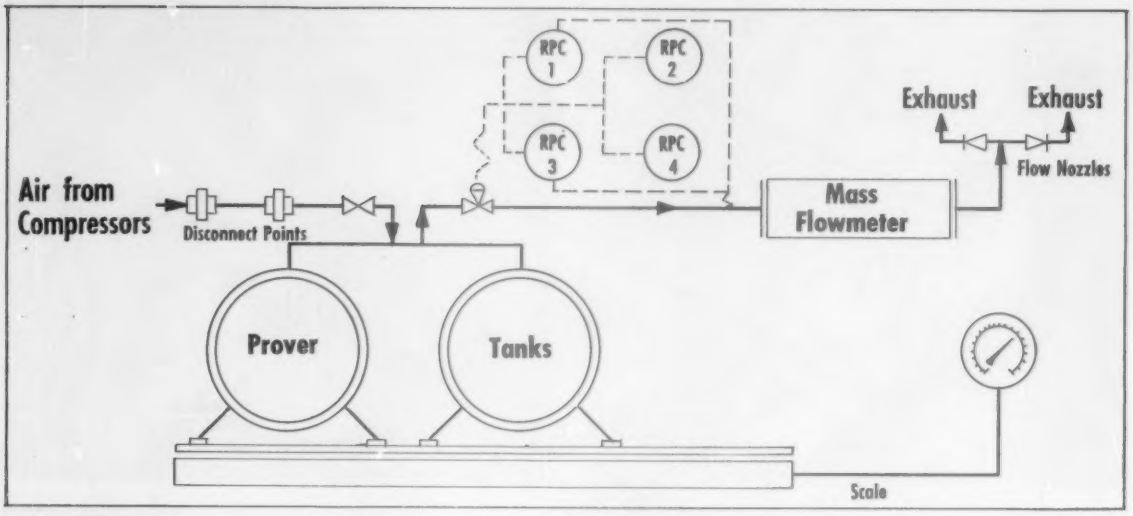
The torque output of the meter is proportional to the mass-flow rate and is not affected by variation in temperature, pressure, density, supercompressibility, and fluid composition.

Prover setup. BS&B designed an elaborate prover setup, specially for calibration and testing of the momentum-change meter. This is shown in diagram, Fig. 2, and accompanying photographs.

The system has a tare weight of 7,000 lb., and air tanks can hold 1,600 lb. of air. The prover is mounted on a scale, and in spite of the mass of the system, the scale is sensitive to 0.1 lb.

The meter to be tested is installed in the meter run as shown in Fig. 2. The two spherical prover tanks are charged to 3,000 psi. with air from compressors. Once the tanks are filled, compressors and piping are disconnected, so that the whole prover system is swinging free and can be weighed accurately.

One of four pressure controllers (choice depending on run pressure) is set at the desired point. Flow rate is determined by sizes of flow nozzles in the exhaust line. When a run is on, the total flow as registered on the meter is checked against the weight of air delivered as shown by the scale. Also, a camera takes a picture of the scale reading every revolution of the flow-indicating gyroscope on the me-



PROVER SETUP includes tanks, pressure controllers, meter run, meter, and exhaust devices. Fig. 2.

ter. Light reflected from mirrors mounted on the gyroscope actuates the camera.

Both accuracy and repeatability can be determined exactly by this calibration procedure.

So far, BS&B has calibrated all prototype meters and some of the production-line units on the prover (some several times). Other meters have been calibrated against a prover - checked "master meter." The meters are installed in series and their outputs compared periodically and over the whole run.

Field tests. These have been conducted as follows:

1. Major oil company, metering of field gas.
2. Oklahoma Natural Gas Co., metering residue gas at natural-gasoline plant.
3. El Paso Natural Gas Co., at city gate.
4. Texas Eastern Transmission Co., conjunction with conventional sales meters. Meter returned, serviced, and sent back to TETCO for similar test, different location.
5. Major gas-transmission company, gas to pipeline. Meter returned, serviced, and delivered to Columbia Gas System, gas to pipeline.
6. United Fuel Gas Co., gas to pipeline.
7. Houston, Texas, Oil and Gas Corp., at city gate station.
8. Major gas-transmission company, gas from gasoline plant.
9. Major gas company, gas to pipeline.

One of these meters went in service in January 1959 and has performed satisfactorily in three different locations. Others have been in service varying amounts of time, averaging about 1 year.

As the result of these tests, it was found mandatory to change the materials in the bearings of the impeller, face gear, and force rod that applies the load to the gyroscope. Material used to make the gears was found to be too soft. Linkages rusted out on one meter in wet-gas service, and it was necessary to change the protective coating on the linkages. Manufacturing faults in the cyclometer register have been corrected.

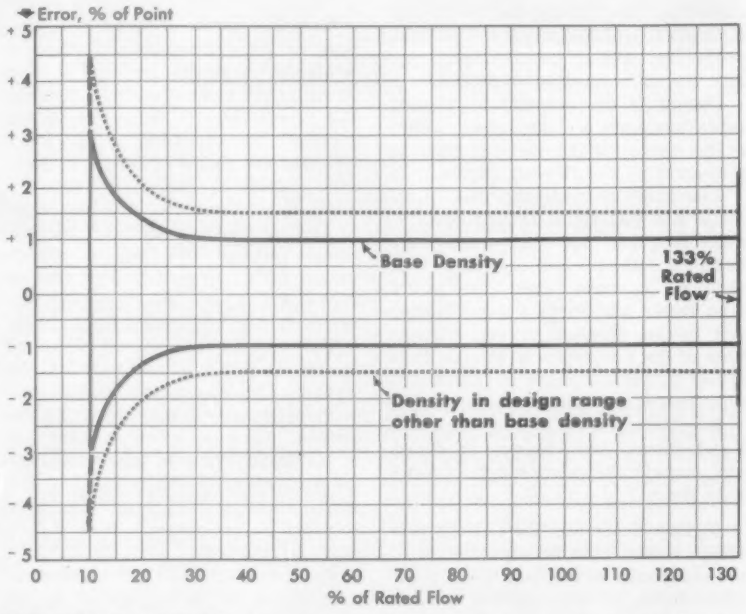
With the indicated changes made, the meter has proved satisfactory in a wide variety of applications.

Meter Accuracy

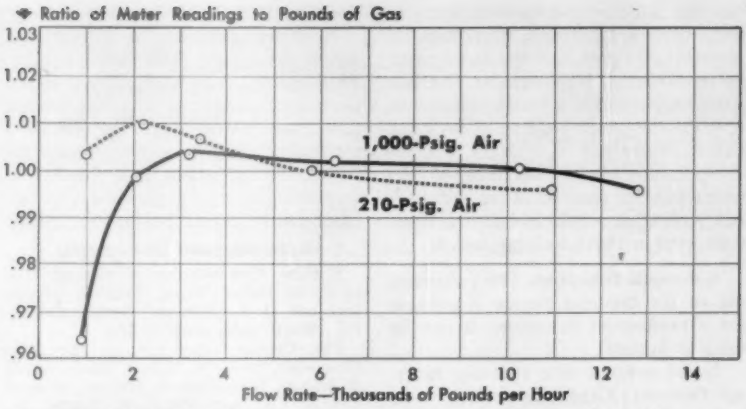
Guaranteed accuracy of the momentum-change mass flowmeter is ±1% **of point reading,** from 30 to 133% of flow rating of meter at base density (solid line in Fig. 3). Base density is a density close to the mid-point of the density range of the meter.

It is calculated by taking reciprocals of each limiting density. These reciprocals are added together and divided by two. Reciprocal of the resulting value is base density. For example, if density range is 1 to 5 lb./ft.^{3}:

$$1/1 + 1/5 = 1.2$$



GUARANTEED ACCURACY of mass flowmeter is 1% when gas is at base density, from 30 to 133% of rated flow. Fig. 3.



SPECIFIC METER CALIBRATION shows accuracies of ± ½% throughout major part of flow range. Fig. 4.

$$1.2/2 = 0.6$$

$1/0.6 = 1.667$ lb./ft.^{3} = base density

Below 30% of rated flow, and above 10%, accuracy of point reading varies from 1 to 3% of point reading. Accuracy is not defined below 10% of rated flow.

If the density of flowing fluid is other than base density, but lies in the specified range, guaranteed accuracy of point reading is ±1.5%, from 30 to 133% of flow rating of meter, as shown by the dotted line in Fig. 3. Below 30% of rated flow, and above 10%, accuracy of point reading varies from 1.5 to 4.5%.

Accuracy of point reading means the per cent deviation from a particular reading. For example, if meter rating is 20,000 lb. per hour, 30% of rated flow = 6,000 lb. per hour. If flowing fluid is at base density, guaranteed accuracy at 30% of rated flow would be ±0.01 × 6,000 = ±60 lb.

An actual calibration curve of a specific meter is shown in Fig. 4. These data were obtained on the positive flow prover. Accuracies of ±½% can be obtained from 40 to 130% of rated flow for a specific meter. Repeatability of the meter is ±¼%.

Conversion to volume: All that is required to convert mass to volume is specific gravity of the flowing fluid at flowing temperature and pressure, or at any desired base conditions.

Suppose a momentum-change mass flowmeter indicated a daily flow of 100,000 lb. of natural gas having a specific gravity of 0.624. What is corresponding volumetric flow at 15.025 psia. pressure and 60° F.?

Density of air at these base conditions is 0.07811 lb./ft.^{3} Density of natural gas = 0.07811 × 0.624 = 0.04874 lb./ft.^{3} Volume of gas is therefore:

$$Q = 100{,}000 \times (1/0.04874)$$
$$= 2.055 \text{ M.M.s.c.f.d.}$$

If it is found necessary to convert the flow to volumetric measure continuously, specific gravity instrumentation will be required. The specific gravity recorder should provide a clear, continuous record of stream gravity, and be accurate to at least ±¼%.

Effects of Flow Variables

Most important specifications for the momentum-change mass flowmeter are density of flowing fluid and capacity. As has already been shown, meter accuracy is greatest when density of flowing fluid is equal to the base density. However, accuracy is acceptable at any density within the design range of the meter.

The meter is accurate for flows between 30 and 133% of capacity.

Temperature and pressure have no effect on the flowmeter, except as they change density. Change in fluid composition has no effect on accuracy of measurement; neither does change in supercompressibility.

Pressure drop across the meter averages about 0.5 psi. at full rated flow. It is a little higher at the lower end of the design pressure range, and a little lower at the high end of the range. If flow approaches the upper maximum of 133% of design, pressure drop is about 1 psi.

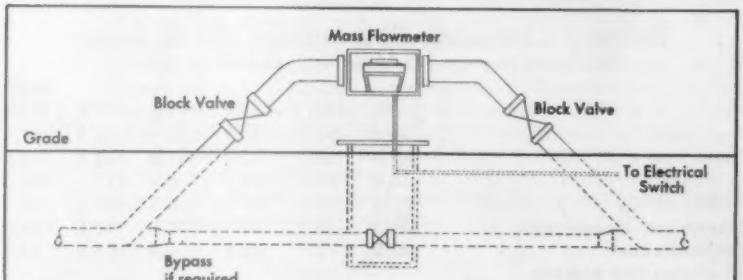
Viscosity variations. These have no measurable effect on meter accuracy in gas applications. Preliminary work indicates that the larger meters can be used to measure fluids up to 100-cp. viscosity with no special calibration required. Low-range meters probably will need calibration in the 20 to 100-cp. range.

Effect of contaminants. Test installations have experienced no difficulty with contaminants, and there has been no abrasive or cutting action noted. Large solid particles, such as welding slag, can jam the meter, but no permanent damage will occur.

Liquid slugs can cause the meter to overrange for a short period of time, but no damage occurs. There has been no trouble with hydrates, even though allied equipment has occasionally frozen. Screens to filter out contaminants should not be necessary, except in extreme cases.

Intermittent flow. The meter has behaved in normal fashion in field application when pulsating flow is known to have existed (such as on a producing well or gas-lift application). When the meter is standing idle, it takes about 10 seconds for it to indicate 98% of a sudden flow. It is a first-order system, with time constant of 2.5 seconds. Thus, the meter reaches 63.2% of any step change in 2.5 seconds, and 98% of the change in 10 seconds.

Likewise, when flow suddenly stops, the meter requires about 10 seconds to 98% of the change. Thus, the two small errors tend to cancel each other out.



TYPICAL INSTALLATION for mass flowmeter shows simplicity of requirements. Fig. 5.

Mechanical Features

The meter is 16½ in. long, 14⅞ in. deep, and 10⅜ in. high, over-all. Outside diameter of the flow tube is 6¾ in., with diameter of flanges 6⅝ in. Pressure rating of the flow tube is 1,500 psi. Pressure on case containing motors and counting mechanisms is atmospheric. Two magnetic

couplings are used to transmit (1) motion to the impeller and (2) torque to the gyroscope. The meter weighs 105 lb. less flanges. Cost varies from $2,250 to $3,120.

Electrical requirements. These call for 110-volt power supply, 50 or 60 cycles, and 55 watts of power. The meter is explosionproof to meet Class 1, Group C and D Underwriters' Code.

Now under development is a thermoelectric converter or generator for remote measuring locations. This device converts heat directly to electricity on the same basic principle as the thermocouple. It appears practical to provide necessary power with a very small gas flame. Cost of gas consumed would be negligible.

Meter ranges. Momentum - change mass flowmeter for gas range in size from 2,500 to 40,000 lb. per hour, and wide variations in gas density may be accommodated. Physical dimensions of all the meters are the same, and they are all mounted between 4-in. flanges.

Installation. A typical installation is shown in Fig. 5. Pipe angle can be varied as desired from the 45° angle shown. Body of the meter is clamped between special flanges by conventional bolting. Practically any type of flat fiber or metallic gasket may be used. Very little piping is needed between the elbows and the flange, only enough to make possible the physical installation of the meter. The piping should have sufficient flexibility so that the flange faces can be spread ½ in. and the meter inserted. It is possible to remove the meter from the line by loosening all the bolts and removing only two of them.

Calibration. Present practice on other types of field meters calls for calibration about once a month. Indications are that this frequency will not be required with the mass flowmeter. However, periodic calibration will be necessary.

Several calibration schemes are possible. First, the meter may be shipped to Oklahoma City, to be calibrated against the primary weighting prover. Or it may be calibrated against a master mass flowmeter, as is the practice with liquid meters. Still another scheme is to calibrate the meter against a critical flow nozzle which has been carefully calibrated on the primary weighing prover.

It may also be possible to calibrate the meter against dead weights which will produce a static torque on the turbine. This technique is still being studied.

Parts replacement. All flowmeter parts are replaceable in the field except the impeller and turbine. Because these units are married, they must be replaced as a pair, and the meter must be recalibrated. Replacement of other parts requires only a bench calibration to bring the meter back to its previous bench settings.

Operation or maintenance of the meter can be performed by any person with even a fair mechanical aptitude after a short training period.

Automatic functions. The pulse output of the contract device is suitable for a number of functions. It can be used to initiate:

1. An average rate recorder (average flow over fixed time period).
2. A batch ticket printer, such as those used on loading operations.
3. An automatic tape printer that will print the total flow over a given time period and automatically reset to zero.
4. A simple counter which will duplicate the reading of the cyclometer. All of these instruments may be positioned locally or remotely.

A device will soon be available to detect precession speed of the gyro. This can be used for control initiations and indications of instantaneous flow rate. Output can be fed to a variety of round or strip-chart recorders or indicators, or it can be fed to electropneumatic converters to actuate conventional pneumatic valves.

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Nelson Refinery Cost Indexes

Published in the first issue each month in the Engineering Section.

Compiled by W. L. Nelson, Techincal Editor and petroleum refinery consultant, Tulsa.

Charts of the indexes are published each year in a late January or early February issue.

Indexes of selected individual items of equipment and materials are also published on the Costimating page in the first issues of the month of January, April, July, and October.

Refinery Construction Cost Index (1946 Basis)

Explained on page 101 of the issue of August 5, 1957.

	1950	1954	1957	1958	1959	May 1960
Pumps, compressors, etc.	138.2	166.5	206.7	214.7	226.5	228.1
Electrical machinery	134.9	160.0	188.9	192.7	195.8	195.0
Internal-combustion engines	126.0	150.5	173.9	178.3	178.5	179.0
Instruments	127.8	154.6	187.4	194.9	201.0	204.3
Heat exchangers	140.0	171.7	203.6	181.2	178.9	195.7
Miscellaneous equipment average	*126.2	160.7	192.1	192.4	196.1	200.4
Materials component	149.5	174.6	201.9	204.2	207.8	208.0
Labor component	144.0	183.3	208.6	220.4	231.6	239.7
Nelson construction index	146.2	179.8	205.9	213.9	222.1	227.0

*Used in computing the Nelson Index until April 1952.

Refinery Operating Cost Indexes (1956 Basis)

Explained on page 171 of the issue of June 1, 1959.

	1946	1952	1954	1958	1959	April 1960
Fuel cost	49.6	81.0	86.5	102.1	103.5	107.1
Labor cost	73.1	88.7	90.9	105.0	102.3	103.9
Wages	52.4	81.5	88.7	105.4	111.5	114.3
Productivity	68.3	90.2	97.1	100.3	109.0	109.9
Investment, maintenance, etc.	51.2	83.6	92.0	109.5	113.7	116.0
Chemicals cost	37.0	72.1	85.7	104.4	107.8	114.5
Operating cost indexes:						
Refinery	58.5	80.5	88.7	105.8	106.8	109.6
Process units†	62.9	82.2	88.4	105.8	106.0	108.2

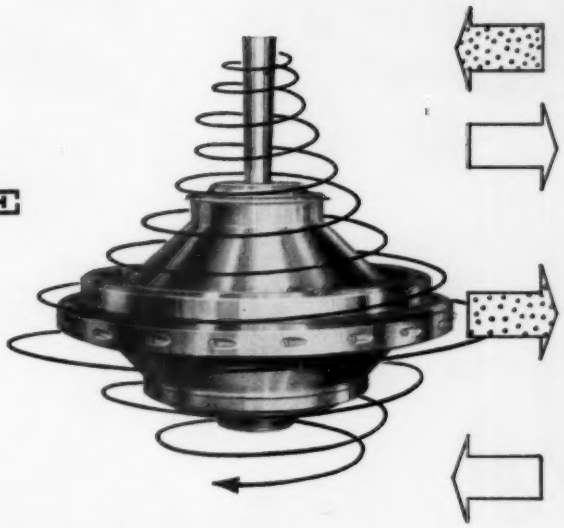
†Add separate index for chemicals, if any are used.

Process Trends from DORR-OLIVER

A SERVICE TO THE PROCESSING INDUSTRIES

THE CENTRIFUGE TAKES OVER

A long-neglected equipment item is developing into a giant that is starting new trends in processing operations



Although the centrifuge has been with us for a long time, its full potentialities are only now being realized in the processing field. Partly, this is due to the increasing demand for faster, more precise methods of separation and classification, adaptable to continuous, automatic operation. More particularly, it is due to radical new developments in the centrifuge itself.

Centrifuges have now become so versatile in operation and have advanced so much in size, power and capability that opportunities for profitable application are virtually unlimited. They are replacing filters, settling tanks, screening and other separation and classification equipment. In many cases, they are cutting days off processing time. Important, too, since the centrifuge substitutes horsepower for size, is the greatly reduced floor space requirements and the smaller amount of critical material needed when handling highly corrosive solutions.

Dorr-Oliver has taken a leading part in the development of these newer, more versatile and more powerful units. An example is the high speed, high pressure Merco® centrifuge for operation at elevated temperatures. A successful application is in separating the catalyst from the polymer in the production of the new high density polyethylene.

Features of Dorr-Oliver design are the overhead bearing and drive which remove some of the limitations of conventional units and the revolutionary return flow principle that permits concentrating, washing, clarifying, classifying and recovery of soluble values at pressures up to 150 psi. Probably the largest centrifuge now in operation is a Merco unit. Rotor speeds up to 3300 rpm and capacities up to 600 gpm are possible. Smaller size, specialized units, among them the Mercone® Screening Centrifuge, are finding application in the food and pharmaceutical industries.

To those interested in the possibilities of centrifugation, Dorr-Oliver offers a wealth of information. For investigation and evaluation, pilot plant models are offered on a sale or rental basis. Just drop a line to Dorr-Oliver Incorporated, Stamford, Connecticut.

Dorr-Oliver offers a wide range of equipment, methods and complete systems for the processing industries. Operations include:

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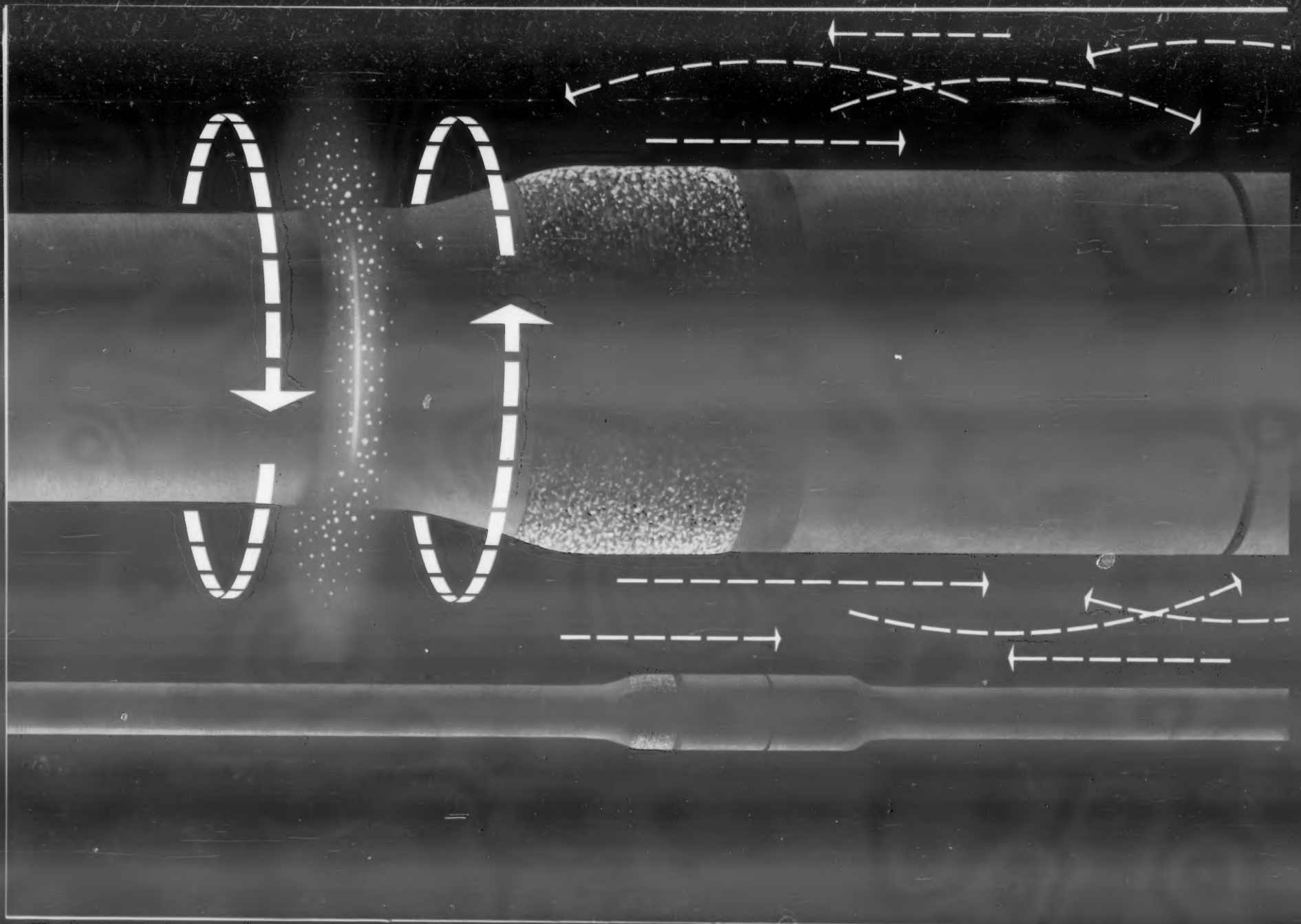

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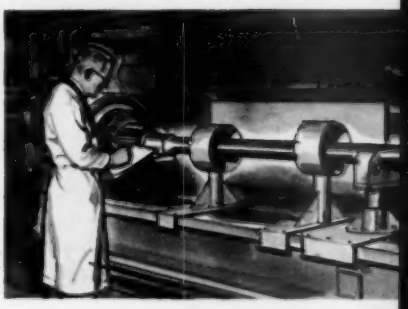

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Short cut to pressure-drop calculations

• The method developed here is short, simple, and accurate for all cases which have been checked. It can be used to determine the pressure drop for turbulent flow of varying density fluids—liquids, gases, or mixtures of the two—in short lengths of process piping such as condensing coils and furnace tubing.

BY J. O. BALL
Professor of Petroleum-Refining Engineering,
Colorado School of Mines

THE METHOD uses only those variables which are found in the standard Fanning pressure-drop equation and the Reynolds number. These equations are described in any standard chemical engineering textbook.

These equations are:

$$\Delta P = \frac{2fLV^2\rho}{gD}$$

$$Re = DV\rho/\mu = DG/\mu$$

Where:

D = diameter, ft.
d = diameter, in.
f = friction factor, turbulent flow, dimensionless.
ΔP = pressure drop due to friction, lb./ft.^{2}
Δp = pressure drop due to friction, psi.
W = lb. per second.
A = cross-sectional area of pipe, ft.^{2}
V = velocity, ft./second.
G = mass velocity, lb./second (ft.^{2}).
G′ = mass velocity, lb./(hr.) (ft.^{2}).
ρ = density, lb./ft.^{3}
g = gravitational constant, 32.2 ft.-lb.$_m$/(lb.$_f$) (second^2).
μ = absolute viscosity, cp.

The only variables involved in these two equations are f, V, ρ, and μ. A simple solution for pressure drop can be realized by substituting mean values for these variables in the above equations.

Using this concept, the following is derived:

$$\Delta p = \frac{\Delta P}{144} = \frac{2fLV^2\rho}{144\,gD}$$

$$= \frac{2fLV^2\rho}{144 \times 32.2 \times d/12} \qquad (1)$$

but $G = W/A = V\rho$ or $V = G/\rho$.

Assuming steady state, G is constant for the problem involved, and the equation may be further simplified:

$$\Delta p = \frac{fLVG}{193\,d} = \frac{fLG^2}{193\,d\rho}$$

Substituting means values into (see box) Equation 1, the new equation is:

$$\Delta p = \frac{fLG^2\,(V_a\,V_b)^{1/2}}{193\,D}$$

$$= \frac{fLG^2}{193\,d\,(\rho_a\,\rho_b)^{1/2}} \qquad (2)$$

Friction factor. To obtain the friction factor, (f), a Reynolds number must be calculated. Then f may be obtained from a graph[1] in which friction factor is plotted as a function of Reynolds number, or it can be calculated from the following equations. These are for smooth pipe only:

$$f = 0.0014 + \frac{0.125}{(Re)^{0.32}}$$

$$f = \frac{0.046}{(Re)^{0.2}}$$

Reynolds number. To calculate a Reynolds number, a value for viscosity must be obtained.

At isothermal conditions there is no problem. However, when there is a wide variation in temperature, a mean viscosity must be determined. This can be done by using the law of the mean.

Viscosity of the liquid is determined for a number of points within the range of temperature of the operation. These viscosities are plotted in the same way as densities are in Fig. 1. If only one viscosity is known, the others may be obtained from the ASTM temperature vs. viscosity plot. The point at which the tangent to the curve is parallel to line ab gives the mean values.

When dealing with mixed-phase flow, the material having the greatest viscosity should be used in the Reynolds number. The reason for this is that it is the heaviest material that is most affected by friction.

Also, the viscosity of the heaviest material is the one which is most easily determined.

For example, if crude oil is being heated and partially vaporized such as in a pipe still, the viscosity of reduced crude coming from the flash drum or fractionating tower can be measured as well as the crude oil entering the still. After determining viscosity of the reduced crude, viscosities at several temperatures may be obtained and a curve drawn. From this curve the mean viscosity is obtained as previously described.

The same procedure is used to calculate the friction factor for condensing vapors. Where the vapors are being condensed in a coil and emerge as a liquid, the first 10% of vapors condensed is the liquid used to obtain the viscosity used in getting the mean.

Equation 2 may also be used to calculate the pressure drop of fluids where there is a large change in volume.

The equation can also be used to determine the pressure drop of vapors or gases. In this case, only the velocities or densities at both ends of the line are necessary. Usually the pressure is known at one end of the line; at the other it is not. To determine the volume of the gas at the unknown pressure, the method of successive approximations is used. A pressure is assumed, and the pressure drop is calculated with the appropriate friction factor.

If the calculated pressure drop (when added or subtracted, depending on which end the known pressure is known) does not check the assumed pressure, another pressure is assumed; this is continued until the calculated pressure equals the assumed.

Densities are obtained in the same manner. This method of calculating pressure drop will be illustrated in the following examples:

Example 1: Four hundred barrels per hour of a 36.5°-API oil is being heated from 60° to 500° F. in a 3.75-in.-diameter coil which is 1,000 ft.

long. Viscosity of the oil at various temperatures is:

Temperature (°F.)	Viscosity (cp.)
60	15.0
100	7.0
200	2.0
300	0.94
400	0.56
500	0.37

Solution: Weight of 36.5°-API oil at 60° F. = 7.013 lb. per gal.

Oil rate = 400 × 42 × 7.013 = 117,600 lb. per hour.

Area of a 3.75-in.-i.d. tube = 0.0767 sq. ft.

G′ = 426.0 lb./hour/ft.²

Mean viscosity, μ_m = 3.0 cp. is taken from a viscosity curve.

$$Re = \frac{G'd}{12\mu\,(0.00672 \times 3{,}600)}$$

$$Re = \frac{3.75 \times 1{,}533{,}000}{12 \times 3.0\,(2.42)}$$

$$= 66{,}000$$

$$f_m = \frac{0.046}{(66{,}000)^{0.2}} = \frac{0.046}{9.20}$$

$$= 0.005$$

At 60° F., sp. gr. of oil = 0.8423; density = 52.70 lb./ft.³

At 500° F., sp. gr. of oil = 0.680; density = 42.45 lb./ft.³

$\rho_m = (\rho_1 \rho_2)^{1/2} = (52.57 \times 42.45)^{1/2}$ = 47.2.

From Equation 2:

$$\Delta p = \frac{0.005 \times 1{,}000 \times (426)^2}{193 \times 3.75 \times 47.2}$$

$$\Delta p = 26.5 \text{ psi.}$$

Assume Δp = 3.5 psi., p_2 = 36.2, and ρ_2 = 0.1882 lb./ft.³

$$\Delta P = \frac{0.0591}{(0.2067 \times 0.1882)^{1/2}}$$

$$= 0.0591/0.197 = 3.0 \text{ psi.}$$

Does not check.

Assume Δp = 3.0, p_2 = 36.7, ρ_2 = 0.1908.

$$\Delta p = \frac{0.0591}{(0.2067 \times 0.1908)^{1/2}}$$

= 0.0591/0.1985 = 2.98 psi. Checks very closely.

Example 2: A 3-in. standard pipe 600 ft. long is carrying 500 c.f.m. of air at 60° F. The initial pressure is 25 psig. What is the pressure drop?

Solution: Equation 2 will be used.

Diameter 3-in. pipe = 3.068 in.

Area 3-in. pipe = 0.0513 sq. ft.

Viscosity of air at 60° F. = 0.018 cp.

Air rate at 60° F. = 500 × 0.0764 = 38.2 lb./minute:

$$G = \frac{38.2}{60 \times 0.0513}$$

= 12.40 lb./second/ft.²

$$Re = \frac{DG}{12 \times 0.018 \times 0.000672}$$

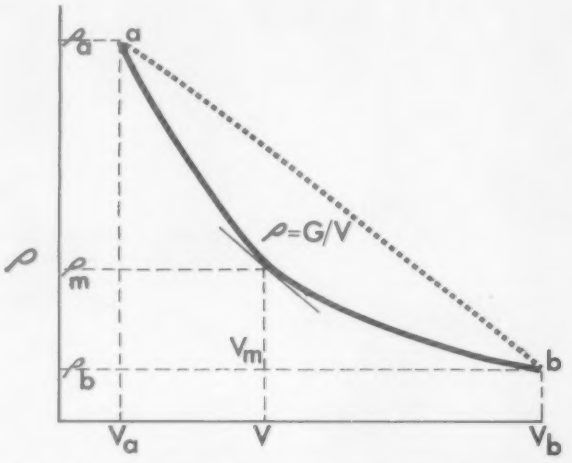
$$Re = \frac{3.068 \times 12.40}{0.000145} = 2.62 \times 10^5$$

f = 0.0047 (from Fig. 2-19).[1]

Density air at entrance ρ_1 = 0.2064 lb./ft.³

How to get mean values of the variables

Starting with G = Vρ, a curve is drawn as shown below:



MEAN VALUE is point at which a tangent to the curve is parallel to line ab. Fig. 1.

The law states that $f'(v) = \frac{f(a) - f(b)}{a - b}$

Where $f(v) = \rho = G/V$.

Also, $f'(V) = d\rho/dV$ tangent to the curve.

Therefore: $d\rho = d(G/V) = -GdV/V^2$ or $d\rho/dV = -G/V^2$ and from the law of the mean:

$$d\rho/dV = -G/V^2 = \frac{f(a) - f(b)}{a - b}$$

which means that the tangent to the curve is parallel to the line ab.

Substituting ρ_a for f (a) and ρ_b for f (b):

$$-\frac{G}{V^2} = \frac{\rho_a - \rho_b}{a - b} = \frac{(G/V)_a - (G/V)_b}{a - b}$$

Solving for V^2:

$$V^2 = V_a V_b, \text{ or } V_m = (V_a V_b)^{1/2}$$

Also, $\rho_m = (\rho_a \rho_b)^{1/2}$, which are the mean values of the variables.

$$\Delta p = \frac{fLG^2}{193\, d\, (\rho_1\, \rho_2)^{1/2}}$$

$$\Delta p = \frac{0.0591}{(0.2064\, \rho_2)^{1/2}}$$

$p_1 = 25 + 14.7 = 39.7$ psia. Assume pressure drop 6 psi., then $p_2 = 33.7$ psia., and $\rho_2 = 0.1755$ lb./ft.^{3}

$$\Delta p = \frac{0.0591}{(0.2064 \times 0.1755)^{1/2}}$$

$$= 0.0591/0.191 = 3.1 \text{ psi.}$$

Does not check.

Assume $p = 3.0$, $p_2 = 36.7$, $\rho_2 = 0.1908$.

$$\Delta p = \frac{0.0591}{(0.2067 \times 0.1908)^{1/2}}$$

$$= 0.0591/0.1985 = 2.98 \text{ psi.}$$

Checks very closely.

Example 3: Seven thousand five hundred barrels per day of 38.8°-API crude is put through a heater in which 71 vol. % is vaporized. The heating coil consists of forty-two 3-in.-i.d. tubes; the flow is split in two equal streams in the convection section. Radiant section consists of sixteen 3-in. i.d. tubes. Both the radiant and convection section tubes are 40 ft. long. The transfer line is 3-in. i.d., 100 ft. long.

Crude enters the convection section at 400° F. where it is heated to 500° F. it arrives at the flash section of the tower at a temperature of 620° F., 71% vaporized. The tower operates at 20 psia.

$\mu_{ave.} = 0.32$ cp. through convection section.

$\mu_{ave.} = 0.30$ cp. through radiant section.

Flash vaporization data are:

Volume % flashed	Temperature (°F.)
0	154
10	216
20	278
30	340
40	402
50	464
60	526
70	588
100	774
Focal point	987
Focal pressure, psia.	848

Solution:

Sp. gr. of 38.8°-API oil at 60° F. = 0.839.

Weight per gallon = 6.918 lb.

Oil rate = 7,500 × (42/24) × 6.918 = 91,000 lb./hour.

Area of 3-in. i.d. tube = 0.0491 ft.^{2}

$$G = W/A = \frac{91{,}000}{3{,}600 \times 0.0491}$$

$$= 516 \text{ lb./second/ft.}^2$$

At 400° F., sp. gr. of oil = 0.705.

At 500° F., sp. gr. of oil = 0.665.

At 400° F., $\rho_1 = 0.705 \times 62.4 = 44.0$ lb./ft.^{3}

At 500° F., $\rho_2 = 0.665 \times 62.4 = 41.5$ lb./ft.^{3}

$\mu_{ave.} = 0.32$ cp.

Pressure drop through convection section:

Split flow G = 516/2 = 258 lb./second/ft.^{2}

$$Re = \frac{DG}{\mu} = \frac{3}{12} \times \frac{258}{0.32 \times 0.000672}$$

$$= 300{,}000$$

$$f = \frac{0.046}{(300{,}000)^{0.2}} = 0.0037 \text{ for}$$

smooth tubes, crude only

If a roughness factor:[2]

$$K/D = \frac{0.0015}{0.25} = 0.0006 \text{ is used,}$$

$$f = 0.0047$$

Equivalent length of line L = 21 (40 + 15) = 1,155 ft. where the equivalent length for a return bend is equal to 15 ft.

Using Equation 6:

$$\Delta p = \frac{fLG^2}{193\, d\, \rho_m} = 14.6 \text{ psi.}$$

For smooth pipe: $\Delta p = 11.5$ psi.

Pressure drop through radiant section:

It is assumed that vaporization starts in the radiant section. The point where this occurs is determined by assuming a temperature to which the crude must be heated; this temperature, when placed on a bubble-point line,[3] should be the pressure at which vaporization starts. This pressure can be checked by using Equation 2. Having the density at the assumed temperature and the density of the mass at the tower, ρ_m is readily calculated. The distance into the radiant section is determined by calculating the amount of heat that must be added to the crude in order for it to reach the temperature assumed.

$$H = WCp\, \Delta t = h' \times L'$$

Where:

H = B.t.u./hour.

W = weight, lb./hour.

Cp = specific heat, B.t.u./lb./°F.

Δt = temperature difference.

h' = heat-transfer coefficient, B.t.u./hour/ft. of tube.

L' = distance from entrance of radiant section to point of assumed temperature.

Using an appropriate factor f, the pressure drop Δp is calculated. To this the tower pressure is added; thus giving the **pressure** at the assumed temperature. If this pressure is the same as the pressure given by the bubble-point line, the calculated pressure drop is correct; if not, another temperature is assumed. This procedure is repeated until the two pressures check.

The equivalent length of line from radiant-section entrance to the tower is:

$$L = 16\,(40 + 15)$$

$$+ 100 \text{ (transfer line)} = 980 \text{ ft.}$$

An initial vaporization temperature of 610° F. is assumed. Average temperature = (500 + 610)/2 = 555° F. used in obtaining Cp. Then, $Cp_{ave.} = 0.74$.

$$H = 91{,}000 \times 0.74\,(610 - 500)$$

$$= 7{,}400{,}000 \text{ B.t.u./hour}$$

Assume that heat is absorbed at the rate of 30,000 B.t.u./hour/ft.^{2} For a 3-in. tube per foot of length:

$$h' = 30{,}000 \times \pi \times (3/12)$$

$$= 21{,}000 \text{ B.t.u./hour/ft. of tube}$$

$$h' \times L' = 7{,}400{,}000 \text{ B.t.u./hour}$$

$$L' = \frac{7{,}400{,}000}{21{,}000} = 352.0 \text{ ft.}$$

Net heating length per tube = approximately 39 ft.

Number of tubes = 352/39 = 9.

Equivalent length L = 9 (40 + 15) = 495 ft.

Distance from point of initial vaporization to tower is:

$$L = 980 - 495 = 485 \text{ ft.}$$

$$Re\ \frac{DG}{\mu} = \frac{3}{12} \times \frac{516}{0.30 \times 0.000672}$$

$$= 640{,}000$$

$$K/D = 0.0006$$

$$f = 0.0046$$

$\rho_3 = 0.625 \times 62.4 = 39.1$ lb./ft.^{3} at 610° F.

Density ρ_4 is now calculated at the tower.

Specific volume of vapors:

$$V = \frac{RT}{(MW)\,p}$$

Where:

R = 10.71 (ft.^{3}) (lb.$_f$)/(sq. in.) (lb.-mole) (°R.).

MW = mol. wt. of vapors = 175 lb./lb.-mole.

p = 20 psia.

T = 460 + 620 = 1,080° R.

$$V_{vap.} = \frac{10.71 \times 1{,}080}{20 \times 175} = 3.31 \text{ ft.}^3\text{/lb.}$$

Specific volume of reduced crude:

Sp. gr. = 0.73 at 620° F.

$$V_o = \frac{1}{0.73 \times 62.4} = 0.0219 \text{ ft.}^3\text{/lb.}$$

71% vapor = 68% of crude

Total volume per pound:

$V = 0.68 \times 3.31 + 0.32 \times 0.0219 = 2.25 + 0.007 = 2.26$ ft.^{3}/lb.

$\rho_4 = 1/2.26 = 0.443$ lb./ft.^{3}

$\rho_m = (\rho_3\,\rho_4)^{1/2} = (39.1 \times 0.443)^{1/2} = 4.16$ lb./ft.^{3}

$$\Delta p = \frac{0.0046 \times 495 \times (516)^2}{193 \times 3 \times 4.16}$$

$$= 249 \text{ psi.}$$

$$p = 249 + 20 = 269 \text{ psia.}$$

The pressure should be 300 psi. for a temperature of 610° F. when placed on the bubble-point line, Fig. 2.

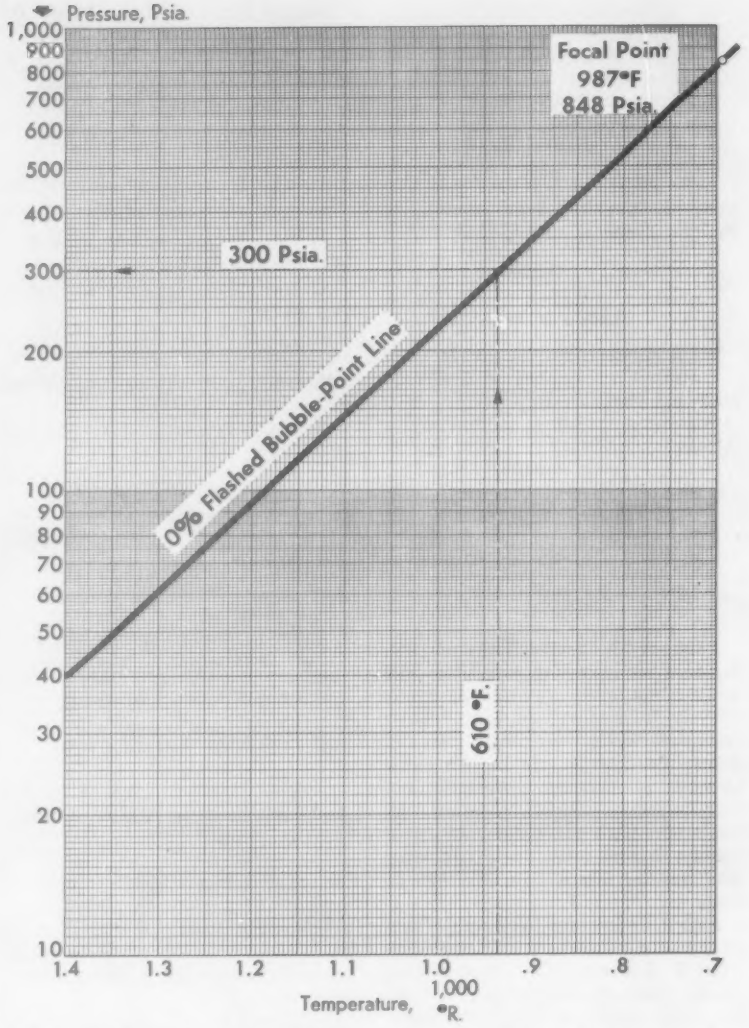
Buthod[2] calculates a pressure of 301 psia. for this same example; thus, it would appear that the calculated friction factor is low. In order that $\Delta p = 300 - 20 = 280$ psi., the friction factor would have to be:

$$f = 0.0052 \text{ or } \Delta p = \frac{249 \times 0.0052}{0.0046}$$

$$= 280 \text{ psi.}$$

Dittus Hildebrand[3] uses f = 0.02/4 = 0.005 and Maker[3] uses f = 0.025/4 = 0.006.

The pressure calculated by using f = 0.005 would be very close to that obtained by assuming a temperature and then obtaining the pressure from a bubble point line; thus, they check.



BUBBLE-POINT LINE can be calculated from an ASTM distillation. Fig. 2.

Pressure drop from convection section to point of vaporization.

$\rho_2 = 41.5$; $\rho_3 = 39.1$ lb./ft.^{3}

$\rho_m = (\rho_2\,\rho_3)^{1/2} = (41.5 \times 39.1)^{1/2} = 40.6$ lb./ft.^{3}

$\mu = 0.36$ cp.; temperature = 500° to 610° F.

$$Re = \frac{DG}{\mu} = \frac{3}{12} \times \frac{0.516}{0.36 \times 0.000672}$$

$$= 534{,}000$$

$$K/D = 0.0006$$

$$f = 0.0048$$

$$\Delta p = \frac{0.0048 \times 492 \times (516)^2}{193 \times 3 \times 40.2}$$

$$= 27.0 \text{ psi.}$$

Total $\Delta p = 15 + 27 + 280$

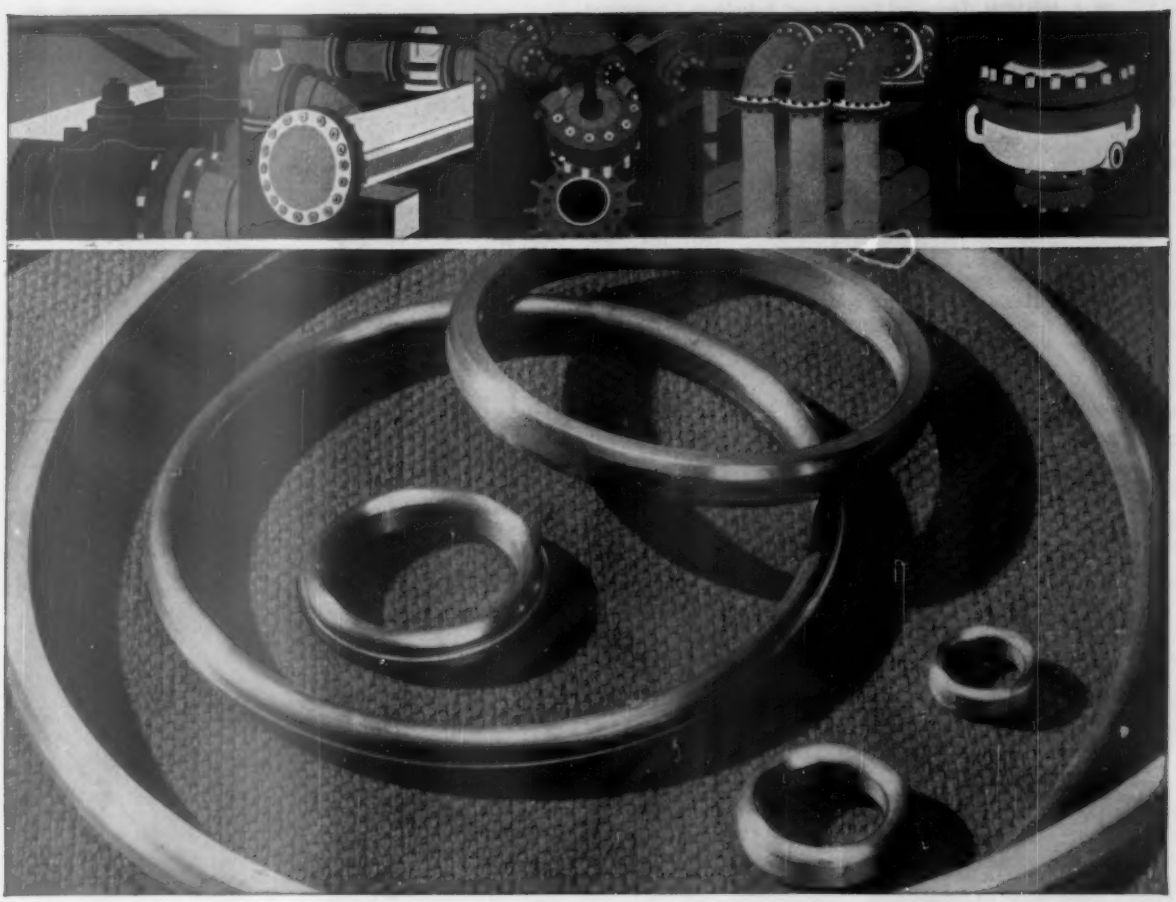
$$= 322 \text{ psi.}$$

The bubble point or 0% flash vaporization line was that calculated by Buthod. The b.p.l. can readily be calculated from an ASTM distillation; the method and curves are given by Nelson.[3]

The above method of calculating pressure drop through heaters is somewhat shorter and easier than many developed in the past.

References

1. Unit Operations of Chemical Engineering, by McCabe and Smith, p. 68, Fig. 2-19.
2. "Pressure Drop in Heaters," by Paul Buthod: The Oil and Gas Journal, July 1, 1957.
3. Petroleum Refinery Engineering, by Nelson, fourth edition, pp. 455-459.



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	1950	1954	1957	1958	1959	May 1960	References*	Index for earlier years (The Oil and Gas Journal) in Costimating and Questions on Technology issues
Operating costs (based on 1956 as 100.0):								
Power, electrical, industrial	97.3	¶98.5	¶101.6	¶102.8	103.2	104.6	Code 541-03	
Fuel, refinery	70.3	86.5	¶112.0	¶102.1	103.5	107.2		No. 4, Mar. 17, 1958
Gulf cargoes	78.0	85.9	123.8	102.9	93.5	97.9		No. 4, Mar. 17, 1958
N. Y. barges	76.9	82.6	112.3	93.0	85.9	89.5		No. 4, Mar. 17, 1958
S. Pedro bunkers	65.9	84.3	129.2	114.6	99.5	¶99.5		No. 4, Mar. 17, 1958
Oklahoma	77.7	62.0	105.3	66.3	78.8	77.8		No. 4, Mar. 17, 1958
Natural gas at wellhead	60.2	¶93.5	¶110.1	¶118.3	130.3	139.4	Code 531-01	
Industrial chemicals	83.3	96.9	101.9	101.8	102.1	102.6	Code 61	No. 58—Oct. 12, 1959
Phosphoric acid	86.7	96.6	100.9	103.4	103.4	103.4	Code 611-07	No. 58—Oct. 12, 1959
Sulfuric acid	80.8	100.0	100.0	100.0	100.0	100.0	Code 611-09	No. 58—Oct. 12, 1959
Ammonia	104.8	103.0	98.3	103.8	105.1	106.5	Code 611-13	No. 58—Oct. 12, 1959
Lime	64.6	92.0	106.4	104.4	106.1	109.2	Code 611-29	No. 58—Oct. 12, 1959
Sodium carbonate	75.5	92.9	104.3	104.3	104.3	104.3	Code 611-65	No. 58—Oct. 12, 1959
Sodium hydroxide	76.3	90.9	103.6	112.6	115.7	115.7	Code 611-69	No. 58—Oct. 12, 1959
Sodium phosphate	87.5	95.5	101.1	104.6	104.6	104.6	Code 611-71	No. 58—Oct. 12, 1959
Furfural	79.0	100.0	100.0	100.0	100.0	100.0	Code 612-63	No. 58—Oct. 12, 1959
MEK, drums	80.0	94.5	105.2	106.9	103.3	103.3	Ch. & E. News	No. 58—Oct. 12, 1959
Phenol	81.3	90.4	103.2	102.7	96.8	95.2	Code 612-83	No. 58—Oct. 12, 1959
TEL	94.1	102.8	101.5	99.9	100.7	100.6	Supplier	No. 58—Oct. 12, 1959
Operating labor (wages)	72.0	88.7	103.9	105.4	111.5	112.9	Employ. & Earn.	No. 55—Nov. 3, 1949
Productivity	85.5	97.1	98.0	100.3	109.0	110.1	Employ. & Earn.	Sept. 24, 1956§
Construction wages (1946 = 100):								
Skilled construction	140.0	174.6	196.3	205.1	214.6	220.9	Eng. News Record	No. 55—Nov. 3, 1949
Common labor	148.1	192.1	221.0	235.7	248.6	258.6	Eng. News Record	No. 55—Nov. 3, 1949
Refinery construction	144.0	183.3	208.6	220.4	231.6	239.7		No. 61—Dec. 15, 1949
Equipment or Materials (1946 = 100):								
Arc-welding machinery		158.4	186.6	193.2	192.1	200.3	Code ‡1176	May 2, 1955§
Boilers, tanks and sheet metal	†136.0	147.3	176.3	175.1	177.2	181.7	Code 1072	April 21, 1952§
Building materials (nonmetallic)	127.0	143.6	159.9	161.7	163.5	164.1	Code ‡13	No. 22—Mar. 17, 1949
Brick—building	132.5	144.7	161.3	162.4	166.4	169.2	Code 1341	No. 20, Mar. 3, 1949
Brick—fireclay	153.4	193.1	232.7	238.7	244.4	244.4	Code 1342	May 30, 1955§
Castings (foundry products)	152.9	181.1	220.5	227.2	231.6	233.7	Code 1015	No. 46—Sept. 1, 1949
Clay products (structural, etc.)	134.6	159.1	184.0	187.0	191.4	193.2	Code 134	No. 20—Mar. 3, 1949
Concrete—ingredients	125.3	142.1	159.7	163.2	164.7	166.8	Code 132	No. 22—Mar. 17, 1949
Concrete products	124.4	138.5	149.0	151.0	152.9	155.0	Code 133	
Electrical machinery	134.9	159.9	¶188.6	192.7	195.8	195.0	Code ‡117	May 2, 1955§
Motors and generators	135.0	157.7	181.2	186.4	186.4	181.4	Code ‡1173	No. 31—May 19, 1949
Switch gear		171.2	¶212.0	218.8	223.5	222.1	Code ‡1175	May 2, 1955§
Transformers	131.6	161.9	188.0	187.3	188.6	182.1	Code ‡1174	No. 31—May 19, 1949
Engines (composite)	126.0	150.5	173.9	178.3	178.5	179.0	Code ‡1154	No. 36—June 23, 1949
Exchangers	140.0	¶171.7	203.6	181.2	179.3	195.7	Manufacturer	No. 2—Oct. 28, 1948
Copper base	....	¶190.7	191.4	168.8	169.6	186.3	Manufacturer	
Steel	....	¶156.8	213.2	190.0	186.4	203.0	Manufacturer	
Fans and blowers	162.9	192.6	236.1	241.7	244.4	244.6	Code 1174	Feb. 17, 1949§
Hand tools	143.2	173.8	214.3	224.7	230.4	233.7	Code 1042	June 27, 1955§
Instruments (composite)	127.8	154.6	187.4	194.9	201.0	204.3	Manufacturer	No. 34—June 9, 1949
Flowmeter (mechanical)	114.0	161.6	203.3	209.9	219.1	227.0	Manufacturer	No. 34—June 9, 1949
Flowmeter (air control)	138.5	179.6	208.2	216.3	223.5	231.3	Manufacturer	No. 34—June 9, 1949
Flowmeter (remote)	135.5	146.5	171.2	176.4	178.1	180.3	Manufacturer	No. 34—June 9, 1949
Potentiometer, 6-point	134.0	167.2	230.9	240.4	258.9	241.0	Manufacturer	No. 34—June 9, 1949
Potentiometer, air control	134.1	150.5	204.6	212.6	231.6	247.8	Manufacturer	No. 34—June 9, 1949
Pressure controller recorder	135.6	166.3	189.3	200.0	200.0	207.1	Manufacturer	No. 34—June 9, 1949
Pressure gage	101.2	108.6	119.2	119.2	119.2	119.2	Manufacturer	No. 34—June 9, 1949
Thermometer (recording)	124.0	152.8	171.8	179.7	179.7	186.0	Manufacturer	No. 34—June 9, 1949
Control valve	133.3	162.0	187.8	199.3	199.3	199.3	Manufacturer	No. 34—June 9, 1949
Lumber (composite)	193.0	197.8	201.8	198.9	214.1	210.6	Code 81	No. 7—Dec. 2, 1948
Southern pine	176.9	181.2	187.6	184.7	190.9	191.2	Code 812	No. 7—Dec. 2, 1948
Other soft woods	230.2	252.7	257.6	251.2	266.8	261.4	Code 813	No. 7—Dec. 2, 1948
Machinery:								
General purposes	136.7	159.9	196.5	199.6	206.0	209.2	Code 114	Feb. 17, 1949§
Construction	140.1	165.9	199.4	209.6	217.0	221.1	Code 112	
Oil field	†135.8	†161.9	193.2	192.5	192.6	193.1	Code 1151	Oct. 10, 1955§
Paints—prepared	140.0	159.0	178.1	180.9	179.9	180.9	Code 621	May 16, 1955§
Pipe:								
Sewer	120.7	140.1	168.0	170.1	176.2	177.8	Code 1345	No. 22—Mar. 17, 1949
Black iron	160.0	195.0	256.1	264.8	263.8	263.8	Code 1014-56	No. 19—Oct. 15, 1956
Six-inch line	†159.0	200.5	268.3	276.9	275.9	275.9	Code 1014-58	May 4, 1957§
Pumps, air compressors, etc.	138.2	166.5	206.7	214.7	226.5	228.1	Code ‡1141	No. 29—May 5, 1949
Steel (iron and steel)	152.9	179.6	224.5	228.2	232.4	230.2	Code 101	No. 61—Dec. 15, 1949
Steel—finished steel	153.7	187.1	232.5	240.6	244.7	244.7	Code 1014	July 25, 1955§
Plate		187.0	241.8	252.7	257.4	257.4	Code 1014-26	Mar. 4, 1957§
Structural shapes	162.7	193.4	252.2	262.8	268.5	268.5	Code ‡1014-31	No. 18—Feb. 17, 1949
Seamless tubes, 2-2¼ in.	149.5	199.4	265.4	277.5	285.1	285.1	Code 1014-61	Sept. 5, 1955§
Valves and fittings	†135.8	197.1	243.4	242.7	257.6	268.3	Code ‡1149 (10 items)	No. 46—Sept. 1, 1949
Nelson Refinery Construction (1946)	146.2	179.8	205.9	213.9	222.1	227.0		No. 36—Aug. 5, 1957
Nelson Refinery Operation (1956)	72.4	88.7	¶106.7	¶105.8	106.8	109.6		No. 2—Mar. 3, 1958
Nelson Refinery Process Operation (1956)	75.1	88.4	¶107.7	105.8	106.0	107.9		No. 2—Mar. 3, 1958

*Code refers to the revised index code number of the Bureau of Labor Statistics, U. S. Department of Labor, "Wholesale Prices."
†Estimated base value for 1946.
‡Not exactly the same items as those published before July 7, 1952.
§Questions on Technology, The Oil and Gas Journal. ¶Revised.

BY W. L. NELSON
Technical Editor and
Petroleum Consultant

Discoloration from asphalt

Approximately how much asphalt will cause a standard white material to go offcolor? R.F.W.

Color is such an elusive property that only the grossest approximations can be made. From Table 1, and the concept of true color, it appears that contamination to the extent of about 1 part per 100,000 will cause standard white (Saybolt chromometer plus 8) to be offcolor (Saybolt minus 2).

The so-called true colors of Table 1 are only an indication of opacity or depth of color. Thus a pale red might have the same opacity as pale green or pale yellow. Stated another way, it is merely a series of numbers which represent the number of dilutions with a colorless material that oils must undergo to match each other in depth of color. Thus an oil of 100 true color when diluted to 1% with a colorless material will then have a true color of 1.

If true colors are to be used in judging contamination of color by black or opaque materials, it is necessary to determine in the laboratory, how many times the black material must be diluted in order to obtain a translucent material that can be rated by means of the conventional color scales. The small amount of information published in the literature is shown in Table 2. The percentages of bottoms for the crude oils listed indicate that the bottoms are solid asphaltic materials boiling above about 1,000° F. Thus the blackest asphalts appear to have true colors of about 100,000.

TABLE 1—APPROXIMATE COMPARISON OF TRUE COLOR WITH THE CONVENTIONAL COLOR SCALES*

Descriptive names	Approx. true color	ASTM & NPA numbers	Tag Robinson numbers	Institute of Petroleum numbers†	Saybolt Chromometer numbers
——	0.20	....	....	....	+30
Water white	0.39	....	....	....	+25
Water white	0.43	....	....	1	+24
Water white	*0.65	....	....	1½	+21
Lily white	0.82	1	20¾	....	....
Superfine white	0.82	....	....	2	+19
Prime white	1.07	....	....	2½	+17
Prime white	*1.25	....	....	....	+16
Prime white	1.48	....	....	3	+15
Standard white	1.60	....	....	3½	+14
Standard white	1.89	....	....	4	+12
Standard white	2.02	....	....	5	+11
Standard white	2.16	....	....	6	+10
Standard white	2.32	....	....	7	+ 9
Cream white	2.35	1½	17½	....	....
Standard white	3.28	....	....	....	+ 1
——	3.9	....	....	....	− 2
Extra pale	5.0	2	12¼	....	....
——	7.35	....	....	....	−16
Extra lemon pale	8.8	2½	10	....	....
Lemon pale	14.2	3	9½	....	....
Extra orange pale	21.3	3½	9	....	....
Orange pale	30.0	4	8½	....	....
Pale	41	4½	5½	....	....
Light red	54	5	3¼	....	....
Dark red	78	6	2	....	....
Claret red	130	7	1¼	....	....
——	182	8	....	....	....

*Based on, NPA + 1.081 (True)$^{0.884}$. The Chromometer scale was superimposed on the NPA scale by inspection of the Lovibond analysis of Saybolt plus 16 and plus 21 colors. †Not official and approximately relative to Saybolt Numbers.

TABLE 2—TRUE COLORS FROM THE LITERATURE*

Item	Material	True Color	Reference
1.	Penn. residue, 165 vis at 210° F.	2,600	4
2.	Penn. residue, after deresining	700	4
3.	Bradford, Pa. cylinder stock, 157 viscosity at 210	3,250	6
4.	Petrolatum from Item 3	11,970	6
5.	Resins by Propane treating of Item 4	28,960	6
6.	Pennsylvania long residuum	3,090	5
7.	Resins by propane treating of Item 6	†59,000	5
8.	Mid-Continent residuum, 400 viscosity at 210	17,000	3
9.	17% bottoms, Barbers Hill crude oil	29,000	1
10.	6% bottoms, Reagan crude oil	33,000	1
11.	12% bottoms, Light Panhandle crude oil	66,400	1
12.	10% bottoms, East Texas crude oil	81,500	1

*The type of true-color scale or formula used was not always stated. Accordingly, the colors are only approximations of the true colors of Table 1. †When treating another oil the color was 70,285.

References

1. Anon., "Prevention of Entrainment in Tube-Still Processing": Ref. Nat. Gaso. Mfr., February 1934, p. 70.
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4. Bown, E. E., "Kendall Operates New Solvent Unit": The Oil and Gas Journal, March 25, 1937, p. 107.
5. Conine, R. C., "Pennsylvania Refiners Learn of Advantages of Propane Dewaxing": The Oil and Gas Journal, Dec. 20, 1934, p. 17.
6. McCluer et al., "Refining of Pennsylvania Oils by Propane Process": The Oil and Gas Journal, March 31, 1938, p. 113.
7. Vinock, H., "Determining True Color on the Tag-Robinson Colorimeter": Ref. Nat. Gaso. Mfr., December 1937, p. 601.
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9. Hoekstra et al., "Radioactive Tracers Pinpoint Entrainment": The Oil and Gas Journal, Jan. 11, 1960, p. 70.

Treating clays or earths

We have large amounts of bauxite in our country. How can we select a suitable material for use in decolorizing lube oil and wax? M. C. F.

The decolorization of oils or wax by adsorption is purely a physical matter of availability, structural strength, and decolorizing power.

The procedure amounts only to testing a large number of clays or earths along with samples of adsorbents known to be satisfactory. Of course, the same temperature should be used in the tests as those employed commercially.

Theoretical studies are wasteful of time compared with reasonable laboratory testing. Nevertheless, the data may be organized by use of the Freundlich equation which is discussed in all physical chemistry and chemical engineering texts. Petroleum Refinery Engineering, fourth edition, pages 308-313, indicates the use of correlation equations and shows the physical properties of some well-known adsorbents.

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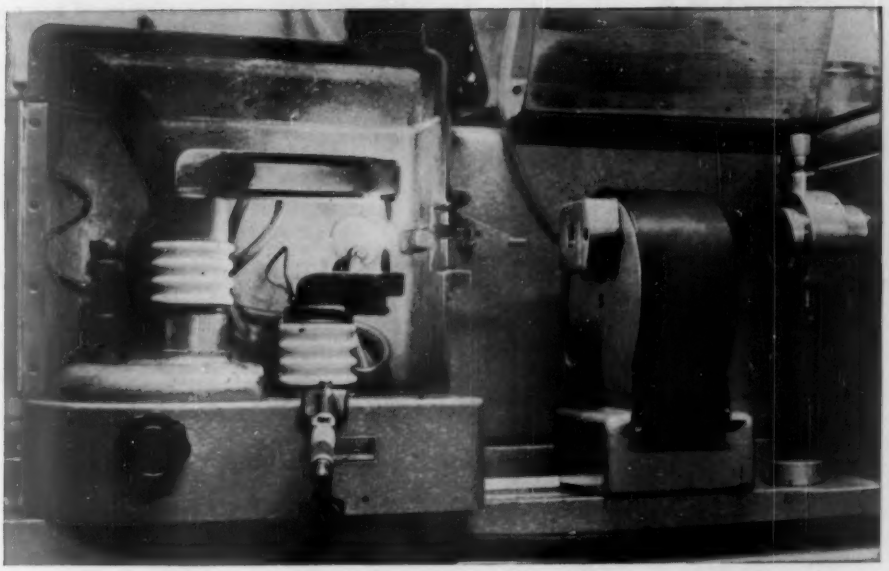
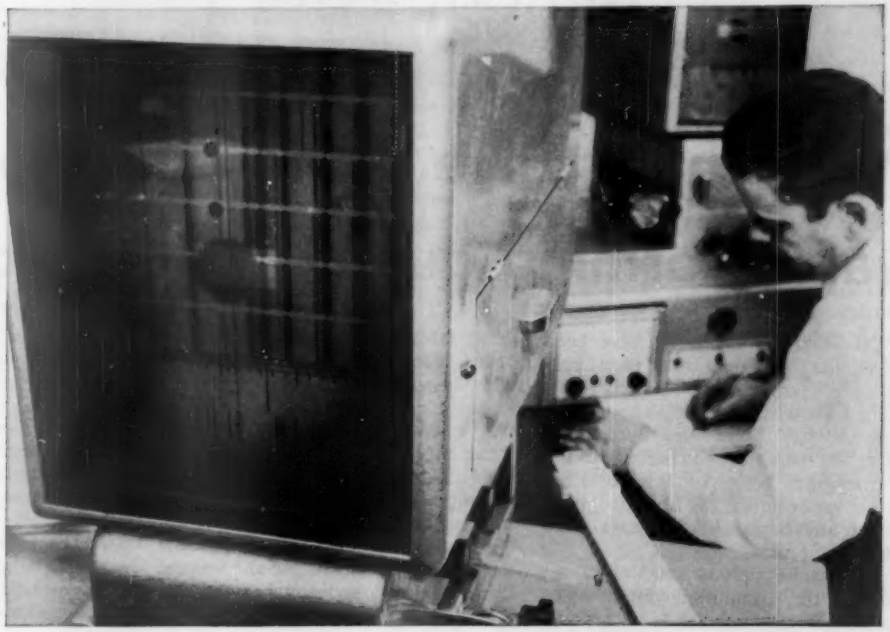


Emission Spectrograph (above) causes undesirable elements in a petroleum sample to emit their characteristic light spectrum which is photographed on a strip of film. In the Densitometer (below) the spectrum on the film is evaluated to identify the presence of metal contaminants down to less than one part per million.



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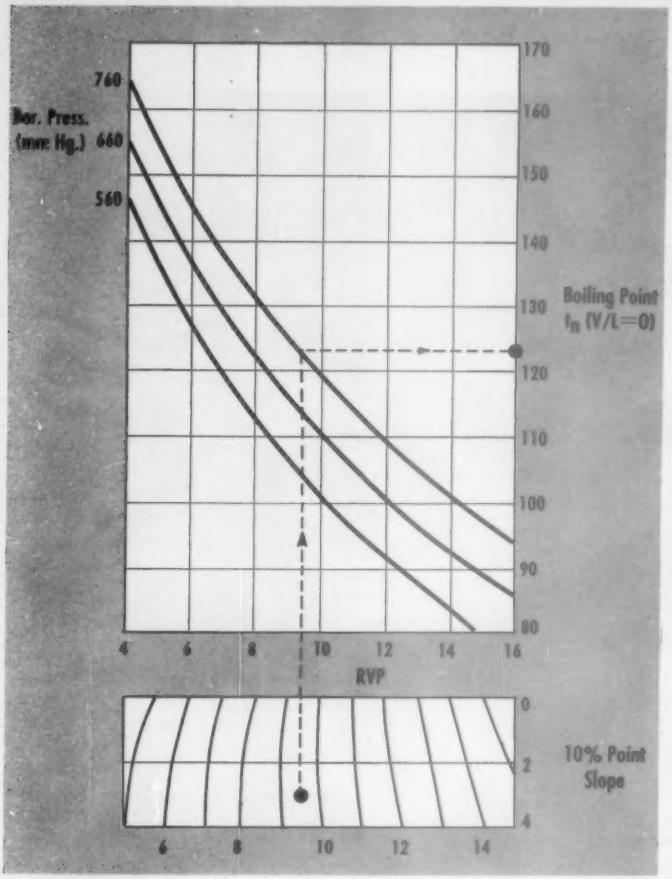
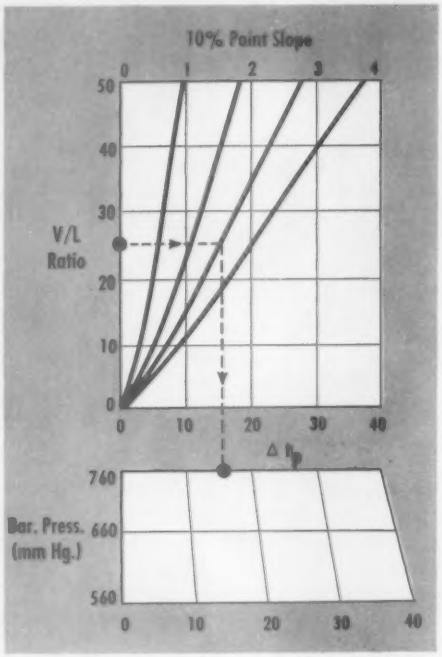


BUBBLE-POINT TEMPERATURE may be evaluated over a range of barometric pressure from 560 to 760 mm. using this chart. Fig. 1. (Left.)

TEMPERATURE INCREASE between V/L = 0 and any desired value up to V/L = 50 may be determined using this chart. Fig. 2. (Below.)



New charts give better clues on vapor-forming qualities of motor fuels

BY OSCAR C. BRIDGEMAN AND ELIZABETH W. ALDRICH
Research and Development Department
Phillips Petroleum Co.

TWO SIMPLE CHARTS have been developed for evaluation of the vapor-forming characteristics of motor fuels from a knowledge of Reid vapor pressure and 10% point slope. Summation of values from the two charts gives the temperature corresponding to any given vapor-liquid (V/L) ratio up to 50 at any barometric pressure from 560 to 760 mm.

The results apply to true V/L ratios; namely, the equilibrium volume V of vapor per unit volume L of residual liquid, on an air-free basis. Applicability to vapor-lock test data requires use of true V/L ratios, rather than apparent V/L ratios as given by the CRC charts, which also do not include the necessary corrections to an air-free basis.

Vapor lock important. The vapor-locking tendencies of car fuel systems have been of major interest both to the automotive and petroleum industries for many years. Methods have been developed[1] to characterize a fuel system regarding tendency to vapor lock under a given set of test conditions.

It is found that each such fuel system has a limiting V/L ratio; namely, the volume V of vapor per unit volume L of liquid passing through the system at the time of vapor lock. This has aroused interest about conditions under which motor fuels will form vapor to produce given V/L ratios, for comparison with the limiting values found in fuel systems.

At constant temperature and pressure, any given petroleum mixture tends to vaporize until an equilibrium volume of vapor V is formed per unit volume of residual liquid L. An equilibrium value is reached because the residual liquid becomes less volatile as vaporization progresses, depending on the composition of the mixture. With pure hydrocarbons, no change in composition occurs, so there is no equilibrium V/L ratio.

Under the specified conditions of temperature and pressure, the V/L ratio is characteristic of the particular petroleum mixture, and therefore can be used to characterize its vapor-forming tendency. In practice, however, it has become customary to express vapor-forming characteristics in reversed terms; namely, the temperature for a given equilibrium V/L ratio at a constant pressure, which is normally taken as one standard atmosphere (760 mm. Hg). Transformation to other pressure levels is possible for more direct application to vapor-lock road-test data.

Air correction. In direct experimental observations of temperature-V/L characteristics, the effect of dissolved air is also included, since it is hard to remove dissolved air from a petroleum mixture without a change in chemical composition, caused by losses of the more volatile components.

Correction for the effect of dis-

solved air is desirable for two reasons. In the first place, air content of petroleum mixtures can vary widely, depending on the degree of air saturation at the temperature of sampling for the experimental tests, and depending on the characteristics of the particular petroleum mixture. Therefore, comparing results with different motor fuels requires correction for the presence of dissolved air.

Secondly, there is very little dissolved air in the fuel at the time of vapor lock in a vehicle, due to high fuel-tank temperatures and consequent low partial pressure of air in the tank. Further, the effect of this low air content becomes negligible at the V/L ratios prevailing at the time of vapor lock. Hence, applying experimental temperature-V/L data to vapor-lock test results requires correction for air content of the samples used in the laboratory tests.

Variation from Equilibrium

The original concept of V/L ratio arose from consideration of two-phase flow in the suction line leading to a fuel pump, where each volume of vapor at the pump inlet displaces an equivalent volume of liquid fuel. Thus at any given speed for a constant-displacement pump, or a variable displacement pump operating at full stroke, the liquid delivery per unit time equals L/(V+L) times the pump displacement per unit time, or in other words equals 1/(1+V/L) times the rated pump capacity.

The values of V and L are the actual volumes of vapor and of liquid flowing into the pump inlet per unit time. In general, equilibrium conditions will not prevail between liquid and vapor at the pump inlet, due to the short time involved in passage through the fuel line under conditions of temperature and pressure gradients.

Vaporization of a volatile fuel approaches the equilibrium value asymptotically for the given conditions, as the time increases indefinitely. The equilibrium air-distillation work of the National Bureau of Standards[2] showed that departure from equilibrium depends only on the rate of fuel flow, and is independent of the effects of wide variations in fuel temperature and volatility.

This also applies to V/L ratio. Hence, in any given car at the point of vapor lock at the given car speed, there is a direct and reproducible relationship between the actual and equilibrium V/L ratios, even though it may not be possible in general to assign numbers to the differences.

Use lab values. Inability to assign numbers to the departure from equilibrium V/L ratios in the fuel system is overcome by a second consideration. In practice, to find the vapor-handling capacity of the fuel system in a given vehicle, vapor-lock tests are run using sets of fuels covering a wide range in 10% point slope.

From these road-test data, and from a knowledge of the vaporization characteristics of the test fuels, there is computed[1] the limiting V/L ratio for freedom from vapor lock in the given test car under given test conditions. This limiting V/L ratio is the equilibrium value as derived from laboratory work on the test fuels, and is related to the actual but nonequilibrium V/L ratio in the test car.

Hence, direct use of laboratory equilibrium V/L ratios permits bridging the gap caused by nonequilibrium vaporization at the fuel-pump inlet.

It appears, therefore, that the V/L ratio of interest is the volume of vapor per unit volume of liquid at equilibrium, with an air-free fuel or with the values converted to an air-free basis. A V/L ratio of this nature is the true V/L ratio of the fuel at the prevailing temperature and pressure. In contrast, many of the recent experimental data have been recorded as apparent V/L ratios; namely, the volume of vapor at equilibrium divided by the total volume of liquid charged to the test apparatus at some lower temperature.

The apparent V/L ratio will differ from the actual equilibrium V/L ratio by an amount depending on the increase in liquid volume due to expansion from the charge temperature to the test temperature, minus the decrease in liquid volume due to vaporization to saturate the vapor space. Further, the recent experimental data have been uncorrected for the presence of dissolved air, so the apparent V/L ratios applies to a total pressure which differs from the recorded pressure by an amount equal to the partial pressure of the air.

Good V/L estimates. Equations have been available[3] for some time which permit evaluation of true V/L ratios directly from distillation and precision vapor-pressure values measured at 100° F. and V/L = 4. When Reid-vapor-pressure values are the only ones available, the equations can be used, but the precision of the computed values will be determined primarily by the precision of the R.v.p. measurements.

Many occasions arise when a close estimate of the V/L-temperature characteristics of a motor fuel is sufficient and accordingly Figs. 1 and 2 are shown in terms of R.v.p. and 10% point-slope S. The major uncertainty in use of these charts is the accuracy of the R.v.p. value, but given an accurate value it is considered that the charts are precise to 1° F. at 760 mm. barometric pressure, with a possible uncertainty up to 2° F. in some cases at a barometric pressure of 560 mm.

Fig. 1 permits evaluation of the bubble-point temperature (V/L = 0) over a range of barometric pressures from 560 to 760 mm. Hg. Fig. 2 permits evaluation of the temperature increase Δt_p between V/L = 0 and any desired value up to V/L = 50, at constant barometric pressure and 10% point slope. In other words, the same values of barometric pressure and 10% point slope should be used with both charts in any one evaluation. The temperature corresponding to any given V/L ratio is then merely the sum of the values obtained from the two charts.

How to use charts. As an example, consider a fuel having a 9.5-psi. R.v.p. and a 10% point slope of 3.0. It is seen from Fig. 1 that the bubble point at 760-mm. pressure is 123° F. From Fig. 2, it is found that Δt_p for V/L = 25 is 16° F., at S = 3.0 and at 760 mm. For this fuel, therefore, the temperature at V/L = 25 equals 123° + 16° = 139° F. at normal atmospheric pressure. The corresponding temperature at V/L = 25 and at 560-mm. barometric pressure would be 104° + 14° = 118° F.

The charts give the temperatures corresponding to true V/L ratios, namely the ratio of vapor volume to residual-liquid volume at the time of equilibrium, on an air-free basis. These temperatures will differ therefore from those evaluated from the complex CRC charts[4] and equations where the V/L ratios are apparent values uncorrected for dissolved air.

For the application to vapor-lock problems, it is considered that true V/L ratios are the more pertinent. This has been evidenced by the success with which true V/L ratios have enabled the satisfactory interpretation of vapor-lock test data[5].

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Sucker-rod failures (continued)

Joint pins, couplings, and rod-on-tubing wear

BY JOSEPH ZABA

SUCKER-ROD joint pin failures usually occur at the vanishing thread of the pin. These are fatigue failures. Since the cross-sectional area of the pin at the point of failure is larger than that at the pin's perfect thread, there must be unfavorable distribution and concentration of stresses at this point. This assumption has been found to be true from photoelastic studies of plastic models of sucker-rod joints.

Undercut pin. Because of this trouble, changes in the design of the API sucker-rod joint have been suggested at different times. The suggestion receiving the most attention is the so-called undercut pin design.[1 2] This was first considered for sucker-rod pins in the early thirties. But the idea for such a design didn't get much support till World War II when the aircraft industry practically eliminated stud and bolt fatigue failures by use of the undercut design.

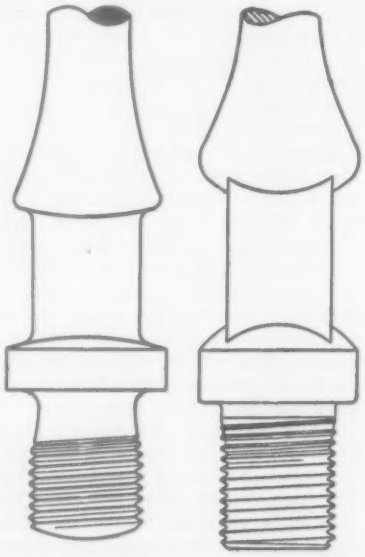
Fig. 24 shows comparison of the present standard API sucker-rod pin and the undercut pin. Note that in the undercut design the body of the pin between the last full thread and the shoulder is undercut to a cylindrical section with diameter smaller than the minor diameter of the threads.

Photoelastic studies showed more streamlined distribution of stresses in the undercut than in the standard API pin. Laboratory tensile fatigue tests were encouraging. So were some of the field tests conducted around 1950.[3] For some reason interest in the undercut pin died down for several years. At present, however, 100,000 ft. of sucker rods with undercut pins are being field tested on the Pacific Coast. Similar tests are being conducted or are planned east of the Rocky Mountains so that considerable field data should be available soon. It is of interest to note that the new tentative API specifications for the ½-in. sucker rod provide for the undercut pin design.

Coupling failures. The beginning of the coupling break is usually on the inside at the point of the first pin thread. It is a fatigue break, which suggests concentration of stresses at this point. About the only remedy in case of frequent failures of this type would be increased cross-sectional area of the coupling. Sometimes these failures are associated with corrosion fatigue due to seeping of the corrosive fluid into the joint. In such cases use of corrosion inhibitor within the joint may be a possible cure.

The coupling failures which originate on the outside are usually a result of improper field handling, hammering of the coupling in particular. In the case of hardened couplings even a moderate hammer blow may break the hardened case. Such a break is in itself a serious stress raiser. It may also be a starting point of failure due to corrosion fatigue.

Because of this, more producers are becoming interested in unhardened couplings which are less susceptible to damage by hammering. The theory seems to be that this approach is necessary because it is difficult if not impossible to eliminate the field practice of hammering the joint. Other users increase their training and supervisory efforts to assure proper handling of the coupling. The question of relative merits of hardened and unhardened couplings is under investigation by a task group of the National Association of Corrosion Engineers. Field tests of strings with alternate couplings are being conducted. But results of these studies are not yet available.



STANDARD API and undercut sucker-rod pin. Fig. 24.

Improper field handling of the couplings is not the only cause of outside coupling failures. Brittle-type failures of highly stressed couplings working in hydrogen sulfide environment have been reported. The failures started on the outside and progressed inwardly. There was no evidence of field mishandling and the failures are blamed on hydrogen embrittlement.

Rod-on-tubing wear. The contact of rods and tubing during the motion of the rods and the resulting wear is a serious operating problem. It involves not only the rod couplings, but also the tubing. The problem seems to be associated with certain operating areas and with certain types of wells. It may be of purely mechanical abrasion type or it may be a combination abrasion and corrosion process.

Rod-on-tubing wear has been associated in the past with crooked-hole conditions and with buckling of rods on the downstroke. More recently attention has been called to still another cause of such a wear, one brought about by the phenomenon of buckling of tubing during the pumping cycle.[4]

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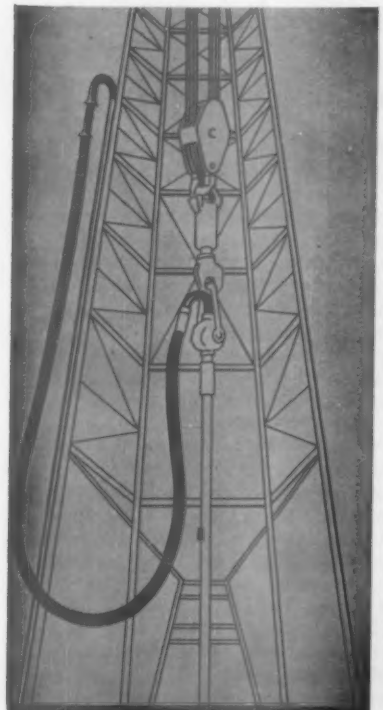

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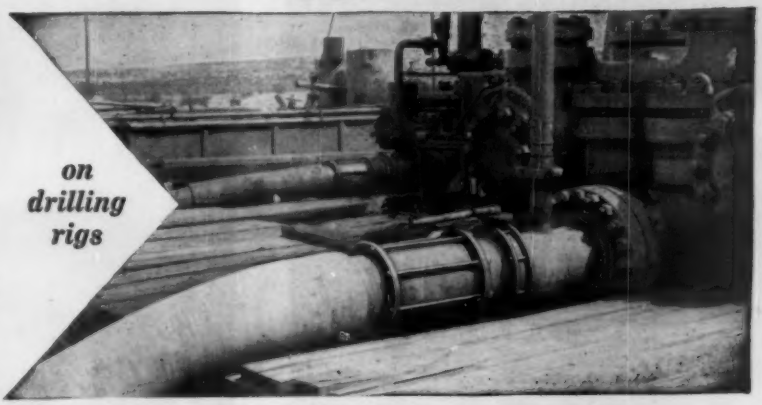

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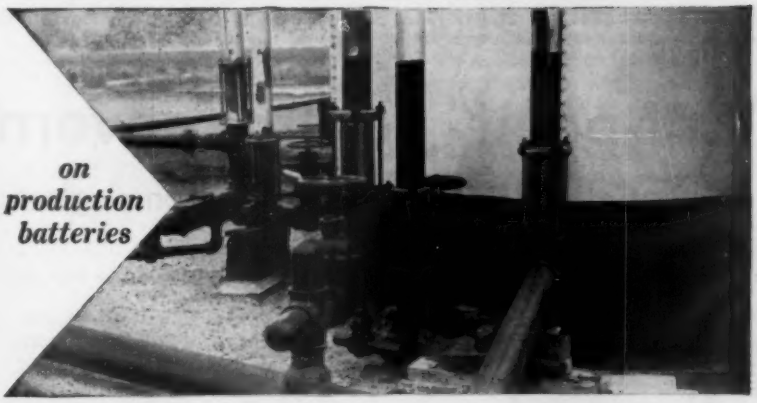

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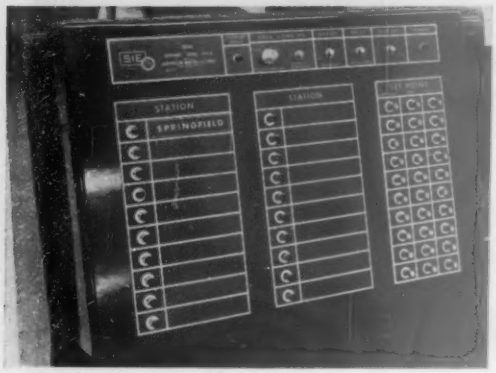


DISPATCHER AT CONTROL CENTER reads complete story of station's conditions on data logger. Station monitor (upper left) reflects conditions set from control center keyboard (lower left).

"Set-point" control governs system

• Colorado Interstate depends on single control in first step to full automatic regulation of pipeline

"SET-POINT" CONTROL is being used by Colorado Interstate Gas Co. in the first stage of an automatic control system.

This method provides for the control of a single condition, i.e., suction or discharge pressure or volume. In the case of the Colorado Interstate system it is the discharge pressure.

The system, as yet, is limited to one station, Springfield, Colo., which is regulated from the control center in Colorado Springs. Eventually the company plans to install similar equipment in all new stations.

The operator at Colorado Springs determines the set point. This sets the discharge pressure at Springfield. The station itself is automatically controlled. Controls there do the rest of the work in adjusting conditions so that they result in the discharge pressure determined at the control center.

Digital system. The control system, described by K. S. Hagius and L. R. Henry of Colorado Interstate in a paper prepared for the ASME Petroleum Division meeting in New Orleans, is depicted in Fig. 1. It uses digital telemetering since it is less costly and more accurate than analog. Furthermore, it will be compatible with the digital on-line computer that is planned for the center. Solid state equipment was chosen because is it less costly and much faster than electromechanical.

One reason for the choice of the set-point system is that less communication is required. The center, being concerned with the control of only one condition, can, therefore, devote more attention to the operation of the entire system.

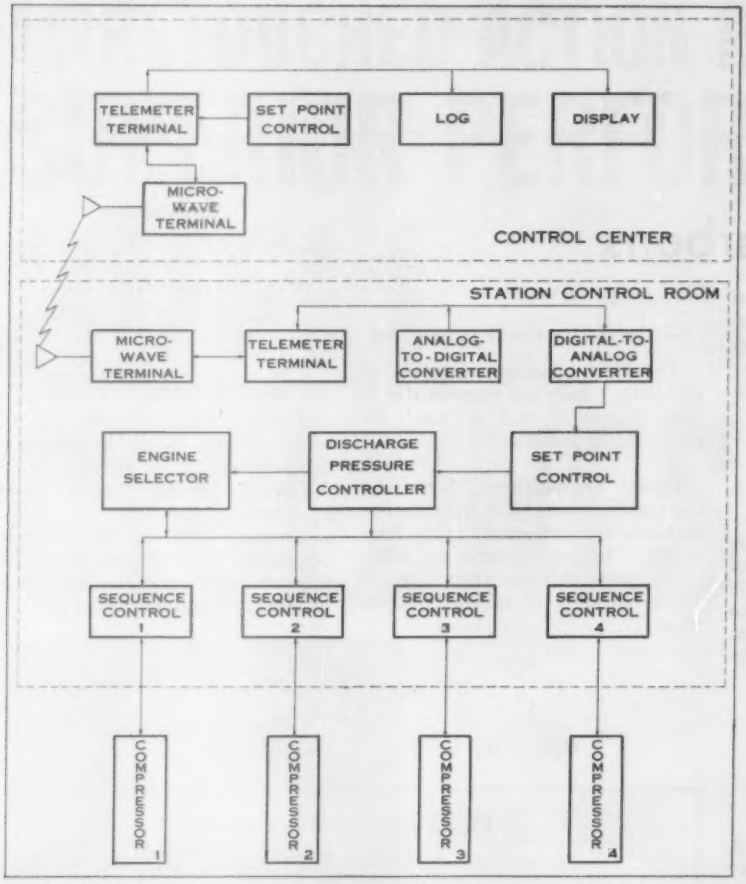
The alternative would be supervisory control. This entails transmission of data on all basic functions from the station to the center, their interpretation there, and the transmission of the control of these functions to the station. Remote supervisory control has the disadvantage of being completely dependent on continuous communication. Loss of communication means control loss or a shutdown.

Needs are few. In the Colorado Interstate system, only a selected number of operating variables are telemetered from the station to the control center. Items which the center needs to know in order to operate the system are: (1) suction and discharge pressures at each station; (2) rates of flow wherever they are measured; (3) indications of quality at input and mixing stations; and (4) any loss of capacity due to compressors out of service. They are displayed on a graphic panel or recorded on a log for permanent record.

When a change is proposed in the throughput of the system, the control center determines the discharge pressure set point for the station. It is telemetered to the station's set-point control which adjusts the set point of the discharge pressure-controller to the proper level.

The discharge - pressure controller compares the actual discharge pressure with the set point and changes the speed of the engines in service to obtain the correct pressure. If the speed range does not meet the set point, the engine selector adjusts the number of engines operating by starting or stopping them through the engine-sequence controls.

Full torque. It is common practice to maintain compressor cylinder clear-



HOW BASIC CONTROL SYSTEM regulates gas flow by pressure set-point. Fig. 1.

affected equipment. Such devices are commonly used since they are faster and more reliable than human control.

Equipment at the control center consists of four principal items: telemeter terminal and logic cabinet, control console, display unit, and data-log typewriter. Push-button controls send the set point to the station and lighted buttons indicate if the station functions accordingly.

Display unit. The display unit shows the set point and discharge and suction pressures from Springfield. Indicator lamps show the number of engines out of service, station "locked out," communication-line failure, no reply, and station on manual control. This information enables the center to control the station as a part of the system.

The system was placed in operation in April 1960 and has been undergoing performance tests since then. The experience time is relatively short and, since it occurred in the summer when loads are light, it is too early to make conclusive statements as to performance. However, every effort has been made to simulate all types of operating situations and to test the equipment over wide and variable loads. No deficiencies have been found.

Based on this experience, Colorado Interstate Gas Co. is proceeding with engineering plans to install similar control equipment in all new stations.

ance at such a level that the suction and discharge pressure imposes full rated torque on the engine. This takes full advantage of the fuel consumption characteristics of the engine and enables it to deliver its rated power whenever the system requires it.

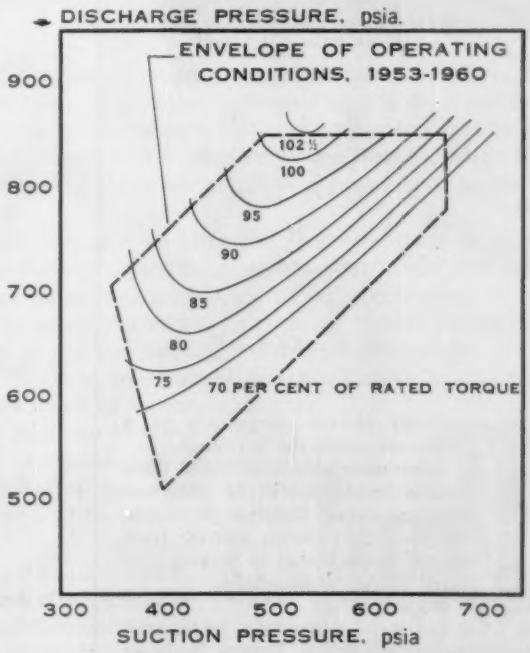
There is some small loss in efficiency as operation down to 70% torque is possible (Fig. 2). However, there is no danger of overload nor is there any danger of loss of capacity since pipeline pressures which unload the cylinders occur only at low flows.

Control of the number and speed of compressors is the one factor which is regulated from the control center. Other functions of the station are automatic. They include compressor sequencing, utility systems and protective and monitoring systems.

The compressor sequencer controls the sequence of operations to start, load, unload, and stop each compressor. It should include provision for manual operation either for fast shutdown under emergency conditions or for complete interlock for verification of each element of the sequence.

Utility control. Control of utility systems should include devices to maintain proper quantities, temperatures and pressures of the jacket water, lube oil, starting air, instrument air, fuel, etc. The electrical system should provide for automatic startup of standby generators and automatic restoration of motor starters after an interruption. The utility system should also include an automatic log to maintain records of operating conditions and to record off-normal and shutdown conditions.

Adequate monitoring and protective devices should be provided to detect hazardous conditions and shutdown



CYLINDER-LOADING CURVES at Springfield station show small fuel-efficiency loss offset by other gains. Fig. 2.

The

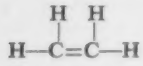
FOREMAN'S PAGE

Here is the composition of

Olefins and cyclic hydrocarbons

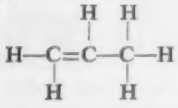
A SECOND FAMILY which does not occur in crude oil but is produced by cracking is called the olefins.

The simplest member of this family is called ethylene.



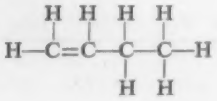
Ethylene

Notice that two arms of each carbon are joined together instead of only one. This we call a double bond and each molecule of an olefin has at least one of these double bonds. The next member is propylene.



Propylene

When we have four carbon atoms, though, there are three possible arrangements:



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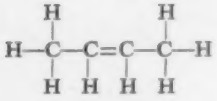

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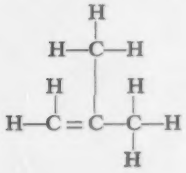
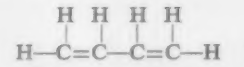


These three compounds as a group are called the butylenes.

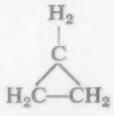
Some molecules have two of these double bonds instead of one, and they are called diolefins or dienes. A common diolefin derived from petroleum and used in making synthetic rubber is butadiene.



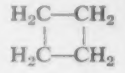
Butadiene

The most important members of the olefin family are given in Fig. 2. Their names all end in "ene," the olefin family trademark.

Cyclic hydrocarbons. Sometimes the carbon atoms of a hydrocarbon molecule are connected so they form a ring. These compounds are called cyclic hydrocarbons. The simplest cyclic paraffin is called cyclopropane.

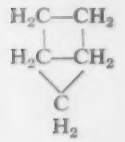


Similarly, there is



Cyclobutane

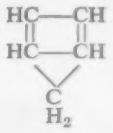
or



Cyclopentane

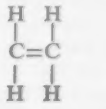
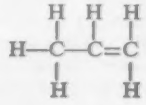
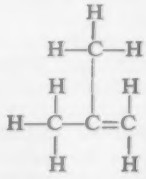
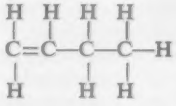
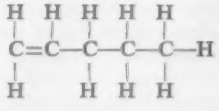
and other higher members of the series. These cyclic hydrocarbons are members of the paraffin family (no double bonds). They are called naphthenes.

Similarly olefins and diolefins sometimes have the ring shape and they are called cyclo-olefins or cyclodiolefins. A common example is



Cyclopentadiene

FIG. 2—COMMON OLEFINS

Name	Formula	Structure	Boiling point, °F.
1. Ethylene	C_2H_4		−155
2. Propylene	C_3H_6		−54
3. Isobutylene	C_4H_8		20
4. Butylene	C_4H_8		21
5. Amylene	C_5H_{10}		86

This material taken from process-training-program manual, Bayway, N. J., refinery of Esso Standard Oil Co.

UNRETOUCHED ACTION PHOTOS PROVE SUPERIOR PERFORMANCE OF BUELL CYCLONES

an ordinary cyclone

THE BUELL CYCLONE
with Shave-Off

These are photographs of as true a test as can be made under laboratory conditions. Notice the difference in the dust patterns! In the Buell Cyclone, on the left, the dust at the top makes less than one revolution before it is trapped by the Shave-Off. It's then channeled down to the lower portion of the Cyclone, well below the clean gas outlet.

Why is the Buell Shave-Off so effective? Primarily because it harnesses the double-eddy current to convey the dust "fines" downward quickly, thereby promoting greatly increased efficiencies. In the ordinary cyclone, as shown on the right, these "fines" concentrate and recirculate at the top, causing erosion of the cyclone. To be collected, the fine dust must travel downward close to the clean gas outlet where much of it escapes. Buell Cyclones have made an impressive record in many years of trouble-free service. To see how their extra efficiency in the Shave-Off can pay off for you, send for our Cyclone Catalog #103. The Buell Engineering Co., Inc., 123 William Street, New York 38, New York. Northern Blower Division, 6405 Barberton Avenue, Cleveland, Ohio. (Subsidiary: Ambuco Ltd., London, England.)

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Here's how one company went about . . .

Solving gas-hydrate problems

BY L. E. CONNEALY
Division Measurement Engineer,
Texas Eastern Transmission Corp.

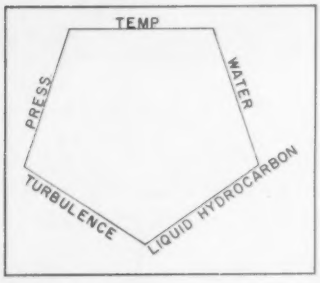
About the author . . .

L. E. Connealy graduated from Texas Technological College in 1949 with a degree in chemistry. Since December of that year he has been in Texas Eastern's Gas-Measurement Department. He is now division measurement engineer at Cuero, Tex., headquarters of one of the company's six operating divisions.

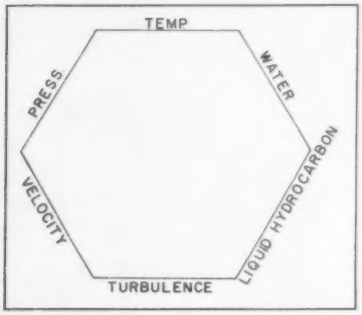
INJECTIONS of methanol are used by Texas Eastern Transmission Corp. to prevent the formation of gas hydrates. It has refined its original methods so that both the frequency of occurrence and the cost of correction have been reduced appreciably.

Since 1953 Texas Eastern has been operating the world's largest wet-gas-gathering system—first as Wilcox Trend Gathering System, a subsidiary company supplying gas to the parent company. This system is now integrated into Texas Eastern as a portion of one of its six operating divisions.

TRIANGLE representing basic hydrate formation.



PENTAGON representing hydrate formation in two-phase system.



HEXAGON representing hydrate formation in two-phase system operating at high throughput.

The first winter of operation brought the formation of the first hydrates. They had been anticipated and alcohol drips were built to be installed as hydrates occurred. The use of drips failed, so it was necessary to try another method of introducing methanol into the line. Gas-operated injection pumps were decided upon.

Old problem. This article gives some of the history of gas hydrates and the operation of Texas Eastern's wet-gas system. Special consideration is given to the use of methanol injection but other types of hydrate prevention are discussed.

Nature unknown. The exact nature of hydrates is not known, but some authorities believe they are definite compounds of a single molecule of hydrocarbon in combination with several molecules of water. Because of their instability, except at low temperatures and high pressure, it is difficult to obtain a sample to determine the exact percentage composition. Conditions of their formation are such that they are sure to be permeated by unknown amounts of hydrocarbon and water, making an accurate analysis difficult.

Regardless of their composition, it is known that hydrates of methane, ethane, and propane do exist. Hydrates of the heavier hydrocarbons may exist, but conditions favorable for their formation are also favorable for ordinary ice and it might be formed instead of a hydrate.

This is the first of a three-part report on the origin of gas hydrate problems and the methods Texas Eastern Transmission Corp. uses to prevent and correct them. Part 1 describes their origin and the use of two common correctives, heaters and glycol. Part 2 will tell why and how Texas Eastern uses methanol, and will appear October 17. Part 3 will outline allied preventive measures, and will appear November 7. This report was presented at the 1960 Texas A. & I. gas-measurement short course.

Hydrate prevention. Substances that act like ice form in natural-gas pipelines under conditions in which ice could not form. When formed in a natural gas pipeline, these substances will be of considerable hindrance to normal gas flow. To permit continuous flow on a wet-gas system, efforts must be made to prevent hydrates from forming.

For each operating pressure there is an equilibrium temperature above which hydrates cannot form, and below which they may form. Turbulent conditions influence hydrate formation and will therefore change the temperature at which they will form. The presence of liquid water or hydrocarbon will also influence their formation.

Equilibrium temperature varies for different hydrocarbons. The temperature is lowest and the corresponding pressure highest for methane; ethane hydrates can form at higher temperature and lower pressures; and the conditions for formation of hydrates with propane are still easier to meet.

Grows fast. Saturation with water vapor is all that is required for hydrate formation. However, if water in vapor is all that is present, the amount of hydrate will be small. If the gas temperature becomes lower because of pressure drop, such as at a regulator station, chances of hydrate

CUT FUEL BILLS 20% WITH A LJUNGSTROM® AIR PREHEATER

The world's largest fluid catalytic cracker at Esso's Bayway Refinery is equipped with a new Ljungstrom Air Preheater. This picture shows the half-ton cold-end elements being installed in the Ljungstrom rotor.

Your biggest refinery operating expense is the money you burn: fuel costs. You can chop fuel bills ⅓ with a Ljungstrom Air Preheater, and here's how:

Your fuel bill drops about 1% for every 45-50°F you raise the temperature of combustion air. Ljungstroms now in service raise the air temperature 1000°F or more — and the rest is simple arithmetic. With a Ljungstrom, four barrels of fuel do the work of five. On fuel savings alone, one eastern refinery came up with net savings of $67,800 in the first year they used a Ljungstrom.

SAME FUEL, MORE HEAT. Ljungstrom economy is flexible economy. If total throughput is more important to you than fuel savings, a Ljungstrom can help boost the capacity of a pipe still at least 10% a day, without any increase in fuel consumption.

THESE ARE FACTS backed up by 25 years of Ljungstrom performance in refineries all over the world. But they're not the only facts. To find out about Ljungstrom's low-cost maintenance, easy inspection, in-service cleanability, space-saving compactness, call or write The Air Preheater Corporation for a free copy of a brochure called "The Ljungstrom Air Preheater for Process Equipment."

THE AIR PREHEATER CORPORATION

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Major refiners report:

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...WHEN YOU ADSORB WITH LINDE MOLECULAR SIEVES

This is only one of many applications which utilize the high capacity and selectivity of LINDE Molecular Sieves. In fact, Molecular Sieves not only outperform other adsorbents, but do other adsorption jobs never before accomplished. Whether in new installations or as replacement adsorbent in existing units, Molecular Sieves can help you minimize both investment and operating costs. More specifically, here's how they are used. . . .

A major petrochemical company has reduced the CO_2 content of its ethylene from 3000 PPM to less than 1PPM. This high purity is achieved in a single-stage process, automatic and non-corrosive, which has proved to be more economical than the alternative four-stage process. Other petrochemical uses include drying of cracked gases, ethylene, hydrogen, liquid propylene, solvents and many other gases and liquids. **Natural gas producers** use Molecular Sieves for drying and sweetening of natural gas, for sweetening of liquid propane and butane, and for drying of adsorber oil. **Petroleum refiners** use them to gain efficiency in drying reformer hydrogen, liquid butane LPG and transformer oil, and for removal of impurities such as CO_2 and mercaptans. **Refrigeration manufacturers** use Molecular Sieves as a desiccant in super-drying refrigerants to eliminate freeze-up and corrosion.

For these and many other adsorbent applications, you can rely on patented LINDE Molecular Sieves to perform more effectively. They are the top quality material of their kind available today, always uniform, with high capacity, high strength, and high bulk density. They are available in regular and special grades to meet your specifications.

LINDE technical know-how—gained from years of laboratory and field work with adsorption problems—can help make Molecular Sieves work profitably for you. For further information, write: Dept. O-101 Linde Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. **In Canada:** Linde Company, Division of Union Carbide Canada Limited, Toronto 7, Canada.

SOME AREAS WHERE MOLECULAR SIEVES IMPROVE ADSORPTION

- Purification of ethylene
- Drying gases, liquids, solvents
- Drying, sweetening natural gas
- Sweetening liquid propane, butane
- Drying jet fuels
- Octane improvement
- As refrigerant desiccant
- Controlled atmosphere purification

LINDE COMPANY

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formation are greater. After the formation of a single crystal, it proceeds rapidly until the supply of materials is exhausted.

Most water enters the gas system as a vapor, but as the gas flows along the line and becomes cooler, water condenses as a liquid. To prevent hydrate formation, the water must be removed from the gas stream, the gas kept at a temperature above the hydrate point and operations kept at a low enough pressure, or some hydrate-preventing substance must be introduced into the line.

It is eessential that some method of prevention of hydrate formation be used, especially during the winter months. In systems handling wet gas, or a two-phase system of gas, liquid hydrocarbons, and water, hydrate problems will be increased.

Heaters

Heating of the gas stream with in-line heaters will prevent hydrates, but has its drawbacks in the cost of equipment and fuel. The use of heat for prevention of gas hydrates is especially good for special applications. These include stream tracing of regulators or use of electricity for heating elements on measuring stations or regulators.

Use of in-line heaters exclusively would be too great an expense. It is possible that a small combustion-type radiant heater could be used as a source of heat on regulating and measuring stations. The use of heat as an exclusive method of preventing freezing where the marketable product is used as combustion material would be uneconomical.

Glycol Injection

Injection of glycol into the gas stream on a wet-gas system will effectively prevent hydrate formation. Since glycols remain in the liquid phase, they can be separated from the other liquids, reconcentrated, and reused. Glycols are highly effective antifreezes and are completely soluble in water. They cost from $1.50 to $2 per gallon.

When present in sufficient quantity and concentration, the glycol will cause additional liquefaction of water vapor. It is possible that the gas may be dehydrated in some degree by the use of glycols. Because the glycols are completely soluble in water, less will be required than when methanol is used. Because of its high vapor pressure, an appreciable portion of methanol stays in the vapor phase of the gas flow.

The glycols will remain in the liquid phase and can be separated at central points along the line, reconcentrated, and then reused. Special equipment permits separation of the glycol-water solution. Also, expensive reconcentration and storage equipment will be required and the use of glycols will need special operating procedures.

Reconcentration equipment will be subject to fouling by any salts dissolved in the water produced with the natural gas. During reconcentration the dissolved salts will condense in equipment, causing corrosion and scaling. Provisions should be made in the processing equipment to remove extraneous material, especially dissolved salts.

Possible remedies would be to have enough towers to remove one or more of them from service for cleaning or the incorporation of a step in the reconcentration process for dissolved salts removal. To cover all the details of a glycol-reconcentrating plant would be too lengthy and beyond the scope of this article.

Glycol loss. When glycols are used there will be some loss by solution in the hydrocarbon portion of the flow. The solution loss should not be appreciable since most of the hydrocarbons involved in normal natural-gas service are of the paraffin family. Aromatic hydrocarbons hold considerable glycol in solution. The solution loss will depend also on the temperatures involved and the concentration of the glycol-water mixture.

Glycols have a characteristic which makes them coat the periphery of the pipe wall with a thin coating. The quantity of glycol which is required to coat the pipe walls is approximately 34.5 gal. per in.-mile. Large-diameter lines will require a considerable amount. (See table.)

With the glycol cost from $1.50 to $2 per gallon, it is expensive to inject, especially where large-diameter lines are involved. The glycol coating of pipe walls will decrease the

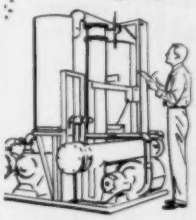
Size line (in.)	Gal. per mile	For 10 miles (gal.)	Cost per 10 miles at $1.50 per gal.
3	103.5	1,035.0	$1,552.50
4	138.0	1,380.0	2,070.00
6	207.0	2,070.0	3,105.00
8	276.0	2,760.0	4,140.00
10	345.0	3,450.0	5,175.00
12	414.0	4,140.0	6,210.00
14	483.0	4,830.0	7,245.00
16	552.0	5,520.0	8,280.00

Carl G. Paulson, Director of Hayes Research and Development Group, Reports...

NEW NITROGEN POTENTIALS

Assume you face the need for high purity nitrogen at a low per-unit cost figure. You want to use it as a heat treating atmosphere . . . or as a "blanket" for hydrocarbons or food products . . . or for any one of a number of industrial applications. How can you bring this safe, inert gas out of the lab and into general use without inflating your costs?

Our R & D group reasoned that a low cost generator was the logical solution and followed up and developed a completely new piece of equipment—the C. I. Hayes "Nitro-Gen." This unique combination of stationary retort and cyclical programmed dryer has cleared the way for production of 99.99% pure inert gas at approximately 20c per thousand cubic feet.



The immediate benefits of low cost nitrogen as a protective heat treating atmosphere were revealed in initial metallurgical applications. For example, test bars of Type C-1141 Carbon Steel were subjected to routine hardening under (1) nitrogen, (2) dissociated ammonia, and (3) endothermic gas atmospheres—each test followed by routine oil quench and tempering. Hardness results from these tests proved identical . . . but a substantial boost in toughness showed up in the bars treated under nitrogen. The nitrogen atmosphere produced 100% greater toughness, according to a transverse break test.

Safety alone makes nitrogen worthy of careful consideration. If this non-combustible gas can be produced efficiently and economically (and we're doing it!), Hayes R&D Engineers believe its potentials are virtually limitless.

Blanketing operations are No. 1 prospects for the Hayes Nitro-Gen . . . in *food, paint, petroleum, chemical,* and *petrochemical* industries . . . where low cost per cubic foot of produced gas means fast pay-back on the job.

We'll gladly demonstrate the Nitro-Gen in our lab or send technical literature if you desire. Request Bulletin 5901-NI.

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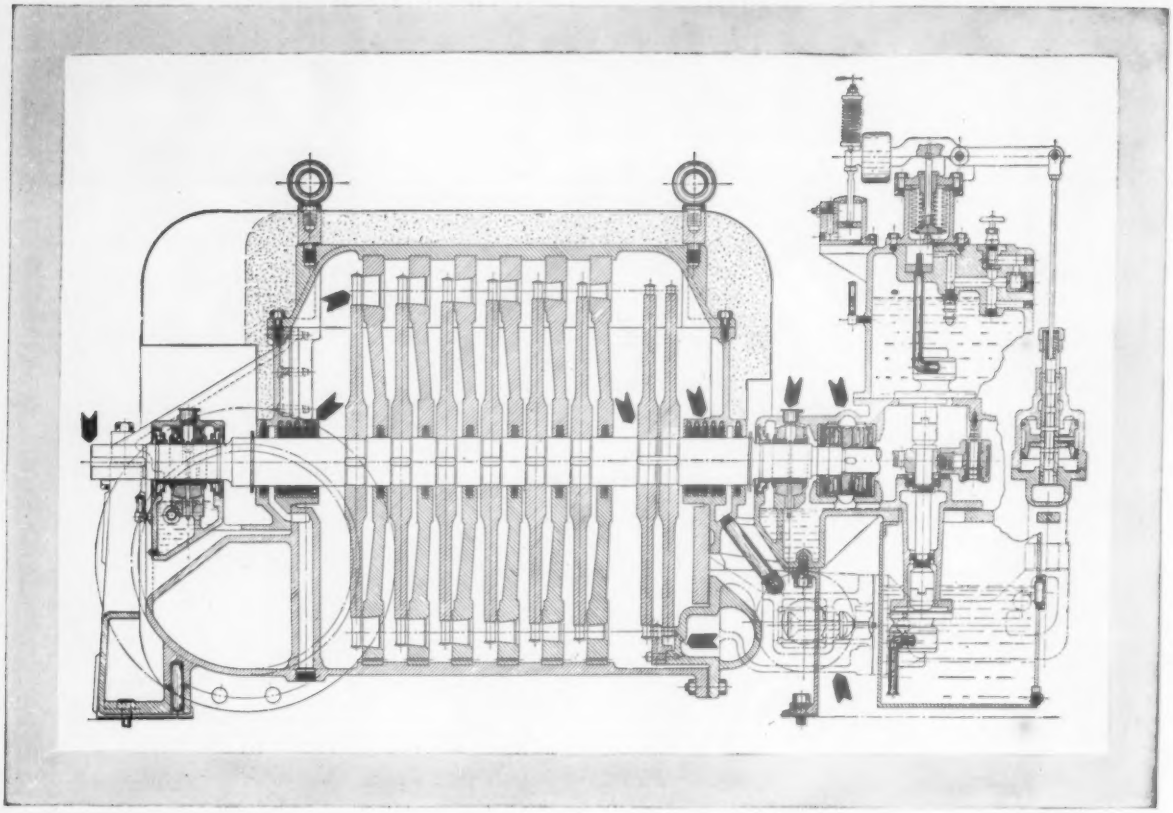

ANOTHER INSIDE STORY OF THE UNIVERSAL ACCEPTANCE OF MURRAY MULTI-STAGE TURBINES IN THE MECHANICAL DRIVE FIELD

- Husky accurately machined shaft.
- Discs shrunk and keyed in place.
- Stainless steel nozzles and blading throughout.
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Our nearest representative will gladly help you solve your mechanical drive turbine requirements. Just write to Murray Iron Works Company, Burlington, Iowa, for his name.

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effective diameter, and probably decrease the pipeline efficiency, dependent on the throughput efficiency at which the line is operating.

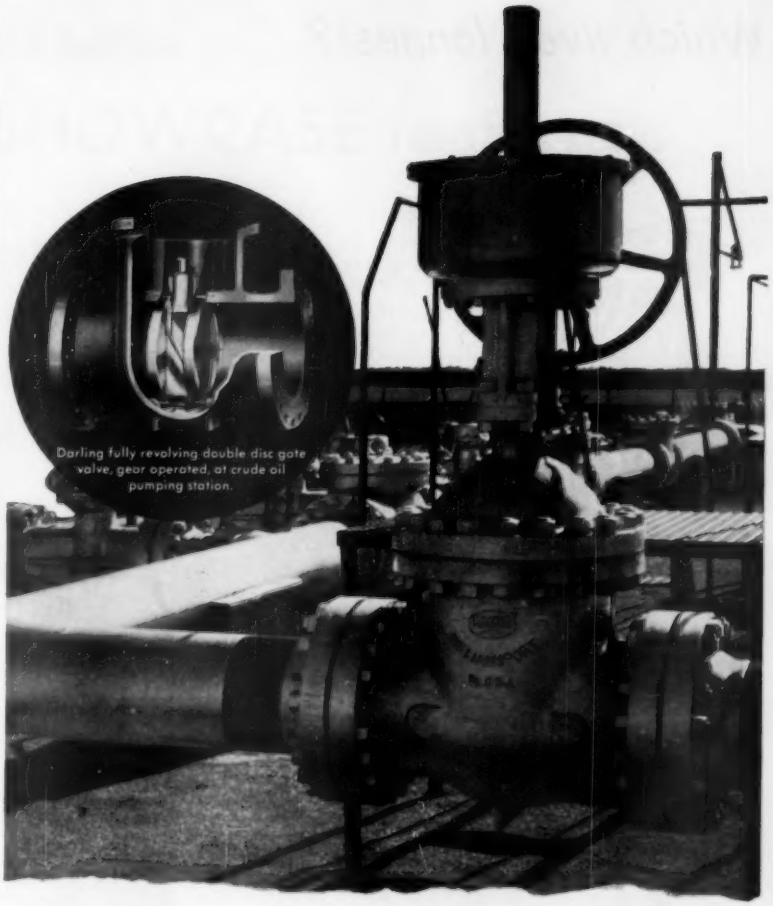
Another factor that should be considered in choosing the injection material is the type of dehydration used at the terminus of the system. Methanol will have no deleterious effect on either a glycol or dry-bed dehydration. Glycol, if carried over into a dry-bed, may cause fouling of the bed. If glycol dehydration is used at the plant, there would be no difficulty in its use for field injection.

Design helps. Glycols might prove successful, when there is an application as a hydrate preventor. Their use should be practical and feasible. If the gas system were designed with glycol injection, recovery, and reconcentration integrated. In an older system, to convert from in-line heaters or methanol injection might prove too great an expense to be feasible. A wet-gas system that has been in service for some time would need facilities for extracting the glycol-water mixture from the other pipeline fluid and processing equipment for reconcentrating the glycol to injection strength.

If a gas hydrate is trying to form in a line, it will show up by a larger-than-normal pressure drop along the line, or will be seen on orifice-meter charts by gradual or sudden pressure rises. These will sometimes return to normal as the hydrate breaks loose.

A gas hydrate can be broken down by reducing the pressure on the line. If the hydrate has set up it might be necessary to reduce the pressure and leave the line out of service for a period of time that can be quite indefinite as to length. This method of pressure reduction may not be practical when the gas that would normally be flowing through the line is needed to supply the system.

A more practical step when a portion of the gas system is blocked by a hydrate is to isolate it and blow to atmosphere to clean the hydrate, and follow the blowdown with a good purge. This method permits keeping most of the gas system in service at all times. It has drawbacks in gas lost to atmosphere, purging, and time spent by employes in keeping lines cleared. A hydrate may be formed at any time of the day or night, and to keep the system in service may require work on a round-the clock basis. When a system is handling wet gas subject to hydrate formation, there must be a definite plan set for freeing hydrates as they occur, or to have some method of preventing the hydrate from forming.



This DARLING gate valve feature can help you

KEEP UP THE GOOD WORK!

Almost all gate valves start out doing a good job. But it's very doubtful if *any* others can match Darlings for prolonged easy closure and freedom from downtime.

It's largely the Darling *fully revolving double discs with parallel seats* (shown above) that make the difference! This principle minimizes friction and uniformly distributes whatever wear there is. What's more these valves can "live" with the line stresses and surges that cause other valves to fail.

Why not get more familiar with how these Darling valves perform and what they offer you in avoiding trouble and downtime? Simply ask for Catalog No. 57.

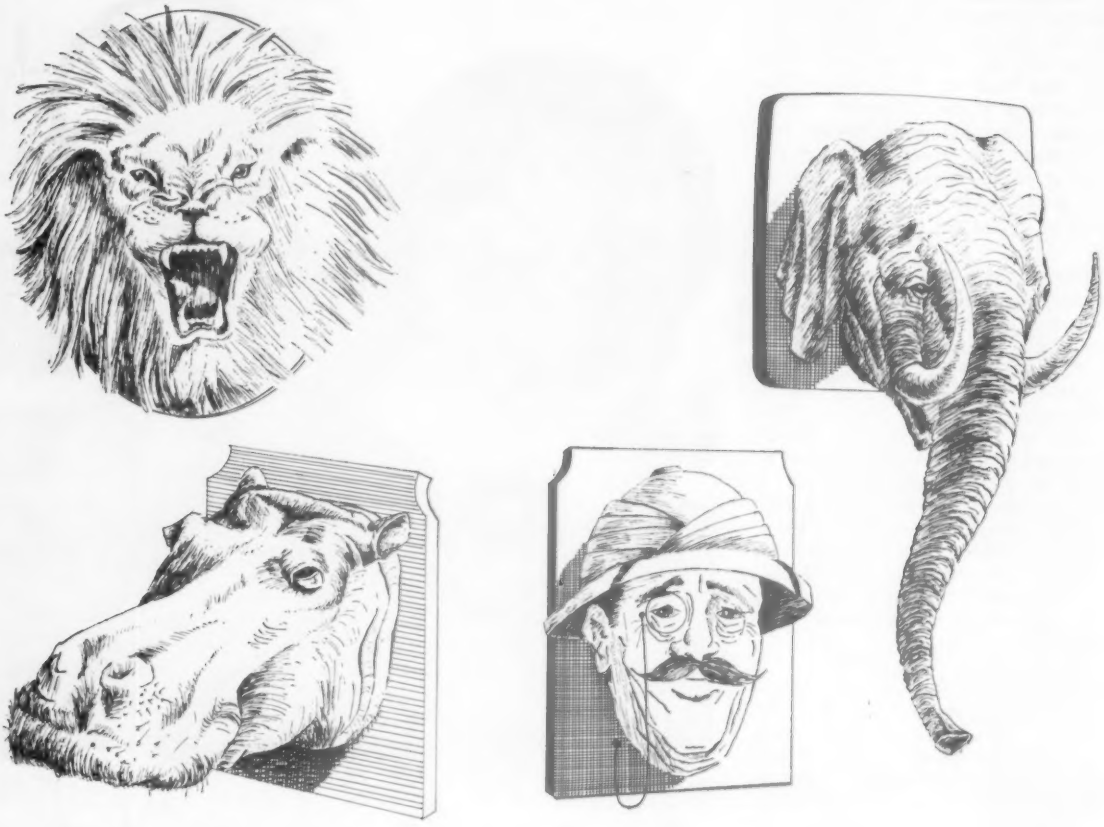
DARLING VALVES

DARLING VALVE & MANUFACTURING CO.

Williamsport 1, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

Which lives longest?



Can you tell the real thing when you see it?

Facts are frequently surprising.

Case in point: You may be in a position to receive caustic by barge, and not know it. Our studies show that this is true of a surprising number of caustic users. If there's a chance that you are one of them, get in touch with us. We produce caustic at Geismar, Louisiana and Wyandotte, Michigan . . . ship it from either point by barge or ocean tanker, truck or tank car. Let us help find the right answer for you. It may save you money.

Wyandotte offers a number of chemicals for the petroleum industry, including materials for drilling muds, gas dehumidification, demulsifying, emulsifying, secondary recovery, water treatment, cementing, sweetening, and many other petroleum, refinery, and petrochemical applications. Get full details from your distributor, or write: *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Baton Rouge, Louisiana. Offices in principal cities.*

ANSWER: If you picked the elephant, you're half right. Men and elephants have about the same life span. The lion lives 15 to 20 years, and the hippo about 30.

* * * * *

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MICHIGAN ALKALI DIVISION

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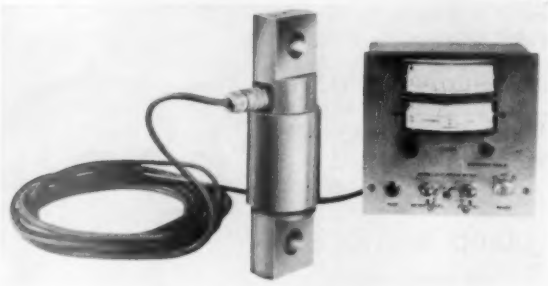
▶ ▶ ▶ New Equipment Section

This week's SHOWCASE features . . .

Instrument measures strain, weight



. . . from 5 to 20,000 lb. on wire lines and down-hole cable operations. Strain or weight changes are registered on a dual-range strain meter with a low-range scale from 0 to 10,000 lb. and a master scale from 0 to 20,000 lb.

Completely electronic, the Model T-10 strain meter is equipped with its own external power supply. Containing seven 4-volt mercury cells, the battery case is temperature-compensated and is claimed to give as much as 300 hours of operation from one set of batteries. Source: **Plastic Applicators, Inc., Box 7631, Houston 7, Tex.**

High-temperature additives

. . . for lube oil and grease are available which promise a way to prevent high-temperature deterioration of lubricating oil and to reduce bearing corrosion. The UOP-225 additive contains no metal or phosphorous. It is said to be stable at temperatures above 500° F. and to leave no combustion ash. Also, it is said to be completely soluble in petroleum and synthetic lubricants. Source: **Universal Oil Products Co., 30 Algonquin Road, Des Plaines, Ill.**

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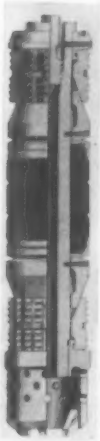
Drillable casing bridge plug



. . . now available is claimed to offer several features that are designed to eliminate the problems of running and setting casing bridge plugs. The Type BC wire-line bridge plug is electric-line set. The plug is said to be shorter than older types. Thus it promises to reduce rig time when the plug is drilled up.

The plug is also claimed to be smaller in diameter than older types but can be set in a wider range of casing weights. This feature can be valuable where accurate casing weight records are not available. Currently the plug comes in only a 5½-in., 13-20-lb. casing size. But a 4½-in. model is being field-tested. Source: **Otis Engineering Corp., Box 35206, Dallas 35, Tex.**

•

Prod bar

. . . with replaceable head is now being produced for soil-resistivity tests. The replaceable head permits the prod bar to last up to five times as long as older types. The bar incorporates two electrodes. Used with the proper instrument, it makes it easy to determine soil resistivity.

The prod bar incorporates a ½-in. tough steel round section for all but the bottom few inches of the shank which permits easy entry into hard soils without impacting or hammering, according to the maker. Standard length is 44 in. But shorter lengths and longer lengths, up to 48 in., are obtainable. Source: **Agra Engineering Co., 1537 E. 10th, Tulsa, Okla.**

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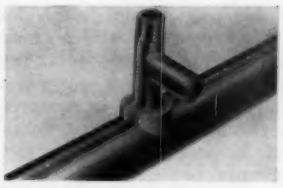

Punch tee

. . . for service connections comes with a high-strength cast-steel body with a ¾-in. base and outlets of either ¾

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or 1-in. male pipe, threaded or smooth for compression couplings or welding. After the Thermotap connection is made, a hardened ⅜-in. punch is screwed into the tee until the pipe is pierced. The punch is then unscrewed until its top end is flush with the top of the tee casing.

The tee is attached by the Thermotap process which involves the use of powdered copper oxide and aluminum fired in the graphite mold, doing away with the need for other welding equipment. Source: **Continental Industries, 7402 E. 41st, Tulsa, Okla.**

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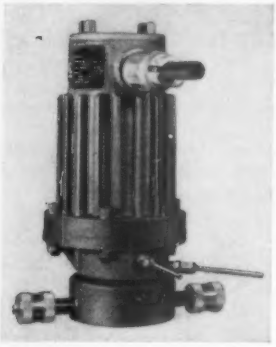

Gas density

. . . analyzed continuously with this Whirlweigh densitometer just announced. It is designed to give an output signal continuously and instantaneously proportional to gas density. The instrument can also be mounted directly on the maker's vortex-velocity type of flowmeter to convert volumetric to true mass-flow measurement.

According to the maker, the output signal is accurate without the use of factors or corrections for pressure, temperature, compressibility, or composition. Consequently, it gives a continuous measure of density of gas in pipe or vessel at line conditions. Source: **Rotron Controls Corp., Woodstock, N. Y.**

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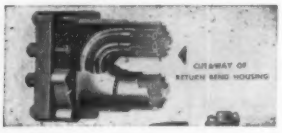

Multitube double-pipe exchanger

. . . on the market is said to permit double pipe units with their standardization advantages to be used in high-capacity applications. According to the maker, the units are also suited for handling light fluids that have high heat-transfer characteristics, such as light gasoline and water.

Four studs make up the head-to-tube closure and the tubeside joint. This studding arrangement is claimed to accelerate assembly and disassembly when inspection is required. The shell nozzles are integral with the shell.

The over-all length of each section varies from 11 ft. 5 in. to 26 ft. 9 in., over-all width is 10 in., and over-all length is 16 in. Seven fintubes are contained in each 4-in. shell. The fins on ⅞-in. o.d. tubes are ¼-in. high. Source: **Brown Fintube Co., 300 Huron St., Elyria, Ohio.**

●

Insert pump anchor

. . . sets easily and permits a pump to be set anywhere in the tubing string without pulling the tubing to provide a seating nipple or shoe, according to the maker of this new Type RP insert pump anchor. Made in three sizes, 2, 2½, and 3 in., the anchor has a reciprocating-set action that reportedly eliminates the need for a clutch in the pump. Also, the pump may be located above in cases where the seating nipple or shoe is too deep or inoperative. The anchor is constructed on a two-piece mandrel. The sealing element is a one-piece sleeve rubber. According to the maker, no rotation is required to set or release the pump anchor. Source: **Guiberson Corp., One of the Dresser Industries, Box 1106, Dallas, Tex.**

●

Lost-circulation kit

. . . offers aid to drilling-mud purchasers in selecting the proper circulation materials for various drilling conditions by clearing up possible confusion over the multiplicity of lost-circulation materials available under over 100 trade names.

Housed in a special box, the kit consists of samples of the 10 basic lost-circulation materials, a graphic illustration of a geologic subsurface cross-section, a listing of the product applications, and directions for correlating the product uses with the various types of lost-circulation zones encountered in oil-well drilling. Source: **Magnet Cove Barium Corp., Box 6504, Houston 5, Tex.**

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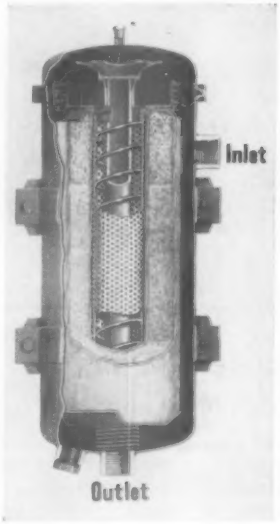

Full-flow single-element filter

. . . on the market is claimed to filter the full-flow oil stream of hot SAE 30 engine oil with a pressure loss of only about 4 psi. at a flow rate of 25 g.p.m.

The filter requires only one inlet and one outlet. A kit is available to convert the maker's 8-937-C units to the new single-element type. Source: **Winslow Engineering & Mfg. Co., Oakland, Calif.**

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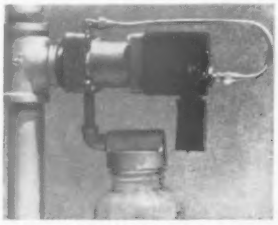
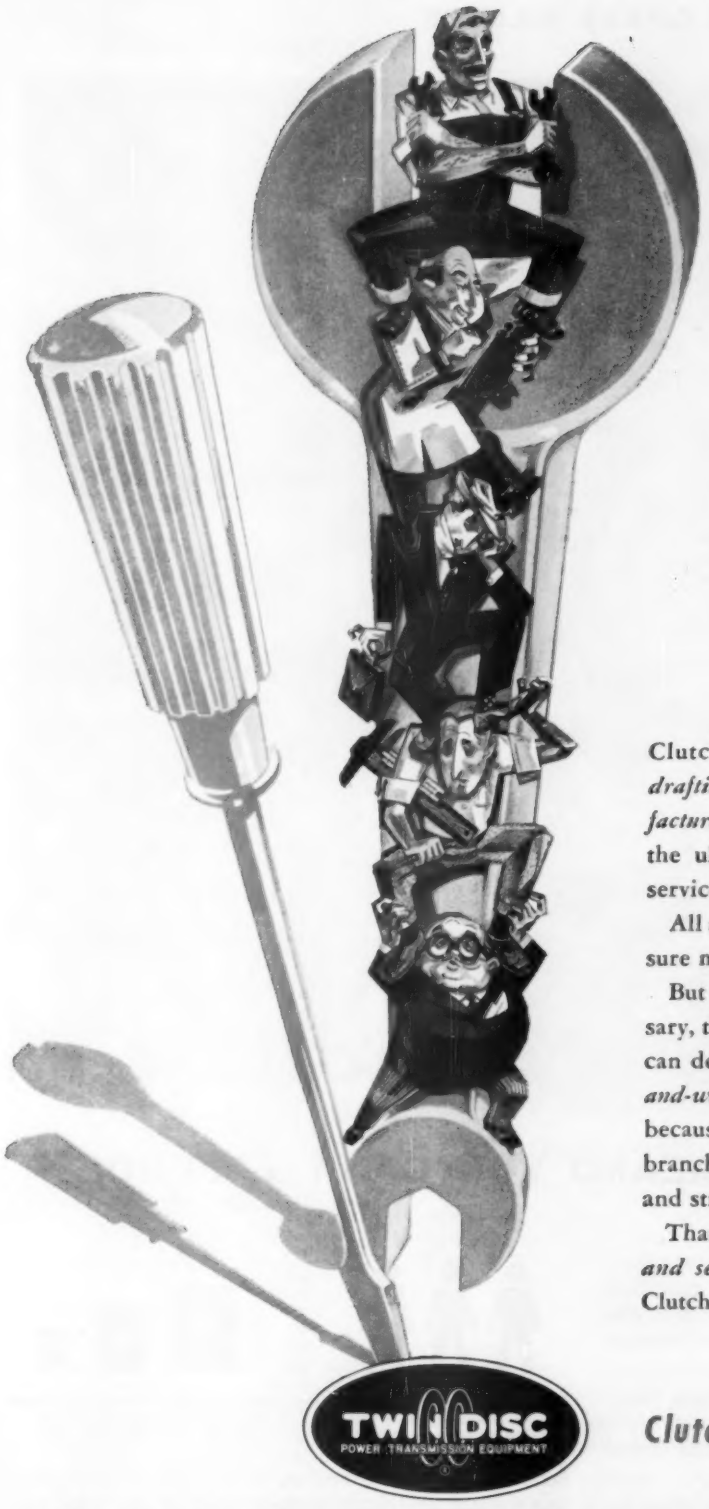


Oil production sampled

. . . automatically with a new sampler now being offered that is said to work with all types of metering equipment for determining the b.s. and w. content of the oil as it comes from the well. The sampler is claimed to provide a more representative sample of



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All are rated conservatively to further assure minimum maintenance requirements.

But when downtime does become necessary, the man with the wrench in his hand can devote it to *repair* time and not *hunt-and-wait* time for replacement parts . . . because Twin Disc maintains *five* factory-branch parts stations, plus 56 well-stocked and strategically located parts depots.

That's why, to be sure of performance—*and service*—always specify Twin Disc Clutches and Hydraulic Drives.

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Your own crews can apply Garlon easily, or a professional contractor will do it for far less than it would cost you to cut, chop, or oil the tops several times a year.

Hand-cutting costs stay constant from year to year

Chemical maintenance costs actually diminish each year

Send for further information, or the name of a qualified professional contractor in your area. Write: THE DOW CHEMICAL COMPANY, Agricultural Chemicals Sales, Dept. 205DC10-3, Midland, Michigan.

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THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

New Equipment

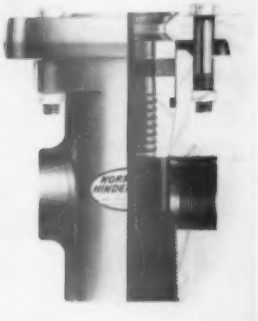
fluid than is possible with older types. It has no valves or springs in the sampling portion of unit which could fail during the sampling cycle. Source: **Miller Sales & Engineering Co., 1609 Rankin Highway, Midland, Tex.**

●

2.5-kw. engine-generator set

. . . on the market, called a Series 31B143S2D-F, features a power control that is claimed to offer maximum power for heavy motor loads and maximum efficiency for operation at other loads. The Series 31 machine reportedly will carry a 2.5-kw. load on a single 115 or 230-volt circuit. Source: **Wincharger Corp., East 7th and Division St., Sioux City 2, Iowa.**

●



Two ways to suspend tubing

. . . are offered by the new Type SL tubing head: mandrel or slip suspension. Available with a 2½-in. EUE 8 round female bottom thread, the head will suspend ¾, 1, or 1¼-in. upset or nonupset tubing or 1½-in. nonupset tubing.

Rated at 1,000-psi. test and 500-psi. working pressure, the head has a top cap that provides a convenient base for a tubing spider. Source: **W. C. Norris, Manufacturer, Box 1739, Tulsa, Okla.**

Automatic pump accumulator unit

. . . on the market is claimed to solve three basic problems confronting drillers: increased safety, easier handling, and reduced cost. The accumulators of the Type E unit are a nonseparator type that need not be removed for field service. They are used as vertical structural members of the unit, welded in place on the skids as the main sections of the assembly. The unit comes in capacities from 20 to 80 gal. with a two-stage, double-acting pump, automatic unloading valve. Source: **Payne Mfg. Co., Box 9364, Houston, Tex.**

●

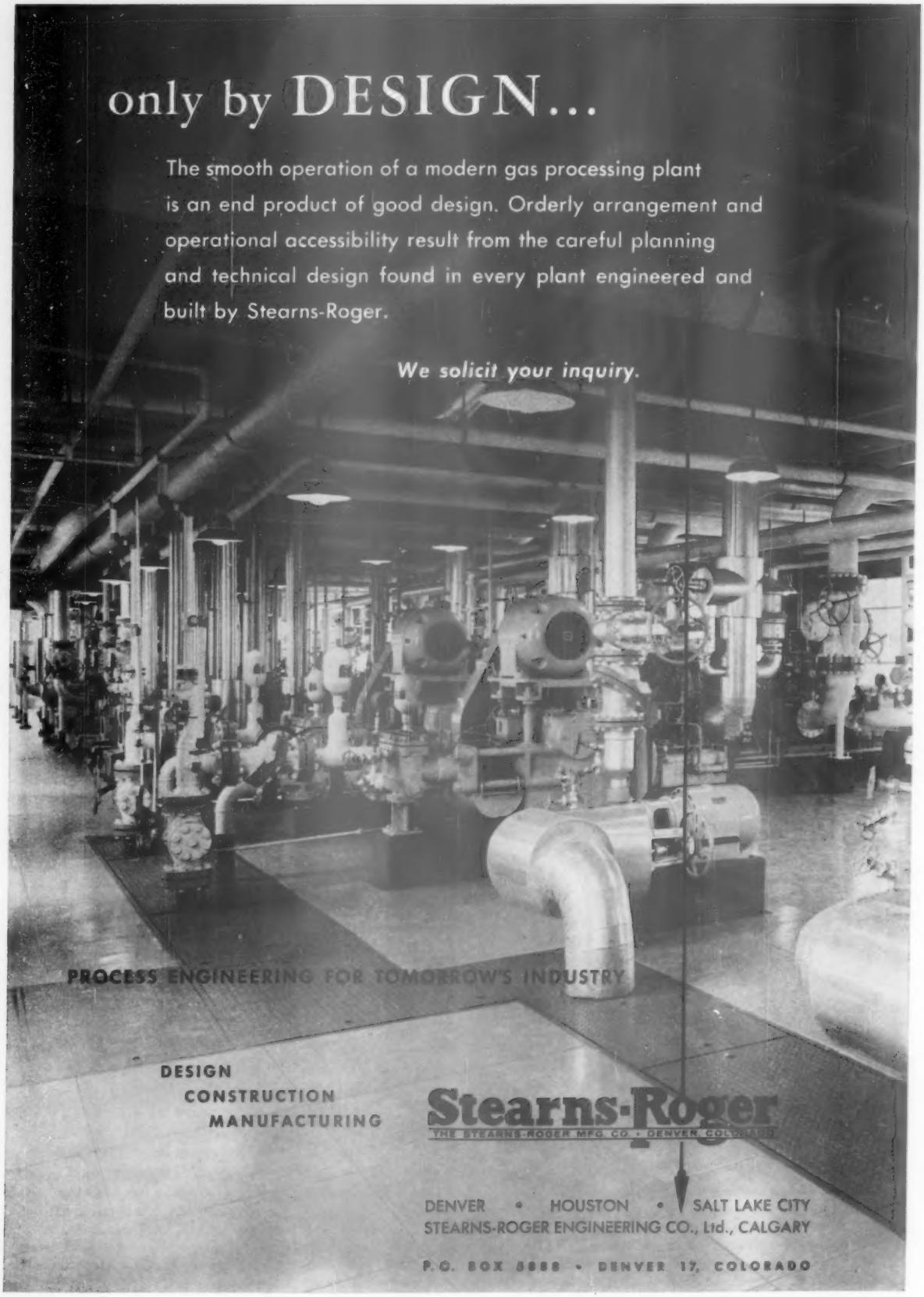
Computer system for process control

. . . now on the market is said to be capable of accepting data directly from analog instrumentation and of providing closed-loop operation. The Libratrol-1000 system includes a built-in voltage-to-digital converter and 8,000-word memory. It is described as a two-address, electronic digital-computer system designed especially for advanced areas of process control. Source: **Librascope Div., General Precision, Inc., Glendale, Calif.**

●

Liquid aids leak search

. . . by forming bubbles when you daub it on pipe joints where leakage is suspected. The Calgon gas-leak detecting fluid is a high-viscosity liquid that, the maker claims, leaves no deposit, is harmless to the skin, nonstaining, and can be used with safety and without danger of fire. A nonfreezing product, it functions effectively with any compressed gas, such as air, carbon dioxide, nitrogen, and natural gas, according to the maker. Source: **Calgon Co., Hagan Center, Pittsburgh 30, Pa.**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SHOWCASE . . .

New Literature

Continuous-recording gravitometer

. . . booklet gives details on the applications, installation, operation, and maintenance of the new Sinclair-Cenco 35090 gravitometer. Booklet 314 is illustrated with photos, graphs, charts, and diagrams which show how the measuring instrument functions and what the electrical setup is for the transducers, power supply, and gage adjustment. Added is a two-page table for converting degrees of API into per cent of span in the gravity range of 30° to 70° API. Source: **Central Scientific Co., 1700 Irving Park Rd., Chicago 13, Ill.**

Subsurface pumps and chokes

. . . are outlined in a 12-page publication which covers features and applications, along with illustrated views of pumps and their working parts. The bulletin is complete with engineering tables, a size and description table, and a sample calculation of a D+B two-zone-pump installation. Source: **Continental-Emsco Co., Box 359, Dallas 21, Tex.**

Bulletin

. . . describes safety tools including wire brushes, hammers, scrapers, pliers, shovels, and wrenches. It lists and describes stock numbers and sizes of each. Source: **Ampco Metal, Inc., Box 2004, Milwaukee 1, Wis.**

Closed-circuit-TV

. . . brochure just issued, explains industrial and commercial television in layman's language. "What Every Businessman Should Know About Closed Circuit TV" is lightly written with a serious intent. The 10-page publication covers basic applications from hazardous viewing to bank administration. Source: **GPL Div., General Precision, Inc., 63 Bedford Rd., Pleasantville, N. Y.**

Glass-fiber insulation

. . . called Ultralite is highlighted in an eight-page brochure which cites money-saving advantages of insulating tanks—even though they do not require close temperature tolerances. A table is given for B.t.u. losses for each square foot of tank surface of uninsulated tanks. It shows effects of the new insulation applied to the same tank. The other charts, thermal efficiency and Ultralite densities, are included. Illustrations include two methods of permanent insulation—one for long-range return on investment, and the other where initial investment is of primary importance. Source: **Gustin-Bacon Mfg. Co., 210 W. 10th St., Kansas City, Mo.**

Drilling straight holes

. . . in crooked-hole country is discussed in a 118-page booklet specially prepared for the rotary-drilling industry. It contains tables for (1) effect of drill-collar size; (2) placement of drill-collar stabilizers; and (3) equilibrium bit weights. Source: **Drilco Oil Tools, Inc., Box 3135, Midland, Tex.**

Steam traps

. . . temperature regulators, and heating specialists are detailed in a new 1960 condensed catalog just off the press. It contains 12 pages of technical details, dimensions, and capacity data. Source: **Sarco Co., Inc., 635 Madison Ave., New York 22, N. Y.**

New life in tired rods

. . . by precision connecting-rod reconditioning is described in a new four-page bulletin, just made available. According to the literature piece, the service insures longer bearing and engine life, equal compression ratio for each cylinder, and a smoother and more economical operation. Source: **Center Precision Co., 614 N. Rockford, Tulsa, Okla.**

Diesel-engine

. . . directory of world-wide sales, service, and parts outlet has just been completed. More than 600 outlets in the United States, Canada, Mexico, and overseas are listed by state, province, and country, giving addresses and telephone numbers. Source: **Detroit Diesel Engine Div., General Motors Corp., 13400 W. Outer Drive, Detroit 28, Mich.**

Maintenance painting

. . . guide discusses different uses for various types of primers and finish coats and shows samples of colors available. In addition, the 24-page publication describes special-purpose paints, along with properties and recommended application methods. One

Sure WE'RE EXCited about our NEW SEAL

AND WHY? NOT! { *Some glowing words from the folks at Parkersburg Rig & Reel's Pumping Unit Division* }

You'd jump and holler, too, if you'd just hit the jackpot with another major engineering advancement in your field. And why be shy in the face of facts? That's what we've got to offer pumping unit buyers. This new oil seal developed and patented by Caterpillar Tractor Co., brings you – for the first time – all the cost-cutting, no-maintenance benefits of sealed-for-life-in-oil wrist pin bearings.

Our announcement ad in this issue brings you the story of this new seal . . . what it is, what it means to you. But we'd like to add a personal postscript to that message, just to tell you how we feel about it.

We're just mighty happy that our engineers, working with Caterpillar Tractor Co., have figured out a way to give you more for your money, in a Parkersburg pumping unit. This new design is bound to save you lots of dollars on each unit over its long, long lifetime – by cutting lubrication and maintenance expense.

The "Parkersburg Partner" supply house is raring to show you the new design, and explain its dollars-and-cents advantages to you. You'll be doing us a favor to hear what he has to tell you. But you'll be doing yourself an even bigger favor . . . when you see what it can do for you.

Parkersburg
RIG & REEL COMPANY
COFFEYVILLE • PARKERSBURG • HOUSTON

Milan,
September 8th 1960

Dalmine S.p.A., leading Italian producer of steel tubes and tubular products, have informed their Customers that the Holding Finsider, to which they belong, have recently reorganized their commercial Services.

In this circumstance, the export business concerning all the products manufactured by the Companies of the Finsider Group has been entrusted to only one Company. As a matter of consequence, all tubular products manufactured by the Dalmine S.p.A. will be henceforth sold abroad through the new organization:

SIDEREXPORT S.p.A.

with Management and Head Office to Tube Division in Milan—Via Brera, 21—Tel. 8858—Cable address: SIDEREXPORT—Milan.

section details steps necessary for proper surface preparation. A two-page chart pin-points the recommended finishes for different types of surfaces, indicating resistance of each finish to chemicals and other destructive agents. Source: **Industrial Maintenance Div., Sherwin - Williams Co., 101 Prospect Ave., N.W., Cleveland 1, Ohio.**

Resistance-welding

. . . data pocket slide chart is now being offered free which selects the proper electrodes for joining many commonly welded ferrous and nonferrous alloys. Correct top and bottom electrodes are indicated for more than 160 combinations of alloys. The 9¼ by 4-in. chart also includes data for determining the proper spot-welding and seam-welding schedules for various thicknesses of low-carbon steel with a conversion table for other alloys. Source: **Ampco Metal, Inc., Box 2004, Milwaukee 1, Wis.**

Facility folder

. . . describes the manufacturing facilities of Trinity Steel Co., Inc. The Dallas company is active in three basic areas, including: custom high-pressure steel vessels for petrochemical, processing, and refining industries; liquefied-petroleum-gas industries (including all segments); and custom fabrication of tank and bulk-handling trailers for liquid and dry bulk materials. Source: **Trinity Steel Co., Inc., 4001 Irving Blvd., Dallas 7, Tex.**

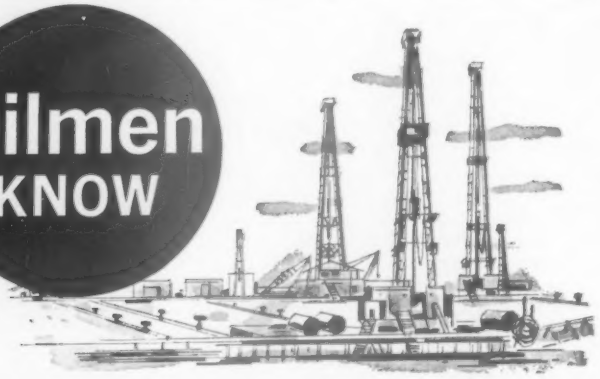
Pipe-leak

. . . repair-clamp inventory can be reduced by using Redi-Clamps and Sta-Grid gaskets, as detailed in a new bulletin recently announced. It reports that the gasket material can be cut to the desired length and secured by as many quick-bolting Redi-Clamps as required. The literature gives details together with installation instructions. Source: **Smith-Blair, Inc., 535 Railroad Ave., South San Francisco, Calif.**

Consolidated-rig

. . . bulletin describes and illustrates the Type 80-B, rated at 1,000 hp., with major applications in the 8,000 to 12,000-ft. depth range. Sixteen-page Bulletin 516 contains over-all photos of the rig and closeups of various components. Included are engineering and operating specifications, a shaft speed diagram, a typical foundation plan, and a performance curve. Source: **National Supply Co., Two Gateway Center, Pittsburgh 22, Pa.**

Oilmen KNOW



As salt-water well tubing, as salt-water gathering and disposal lines, as oil flow lines . . . Western ABS semi-rigid plastic pipe is without equal in the oil fields!

Western Semi-Rigid PLASTIC PIPE Saves

MONEY

Semi-Rigid pipe made of ABS plastics costs less to buy, and costs less to install. It needs no expensive bedding, less ditching . . . never requires costly handling equipment. And it's greater serviceability virtually eliminates the need for replacement.

TIME

Effortless to carry . . . quickly jointed, two men can lay several thousand feet of ABS pipe in a single day. Easily sawed, drilled or threaded, it is permanently solvent-welded in seconds. Ready-to-use ABS pipe fittings require only the simplest tools.

TROUBLE

Western ABS has superior resistance to corrosion, chemicals and crude oil . . . will not rust, or scale and is free from electroytic action. It's smooth interior means lower friction, faster flow. Western ABS has both high impact and high tensile strength as well as high temperature resistance.

For further information write, wire or call:

WESTERN PLASTICS CORPORATION

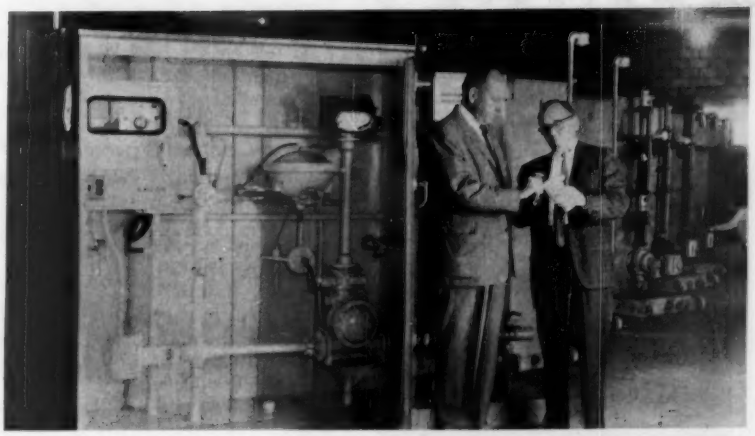
1515 W. 2nd Street • Hastings, Nebr. • Phone 3-1361

▶▶▶ Equipment Men Notes

Lane-Wells opens district office

. . . in Perry, Okla., and opens technical oil-field service locations in Woodland, Calif., and Ruston, La. The locations will offer the company's newest developments in electrical logging, nuclear logging, perforating, Vibro-Frac, packers, and bridging plugs.

James Pickett will be district manager at Perry; R. H. Gerecke and D. W. Ford will be field service engineers in charge at Woodland and Ruston, respectively.



EXAMINING COMPONENT of Major Engineering Co.'s meter automatic custody transfer unit at Major's Tulsa plant are Rainey Elliott (left), president of Jones & Laughlin Supply Division, and Ralph Hill, Major's president. The units, manufactured on the production line shown, will be stocked and sold by J&L throughout the United States and Canada.

Bill Brockwell is named manager

. . . of Vinson Supply Co.'s Kansas City area sales office where he will offer sales-engineering service on Ladish welding fittings and flanges, Crane valves, Nordstrom plug valves, Chase brass condenser tubes, and National tubular products. Brockwell formerly represented Ladish Co., manufacturer of Vinson's welding fittings and flanges, throughout the Mid-Continent area.

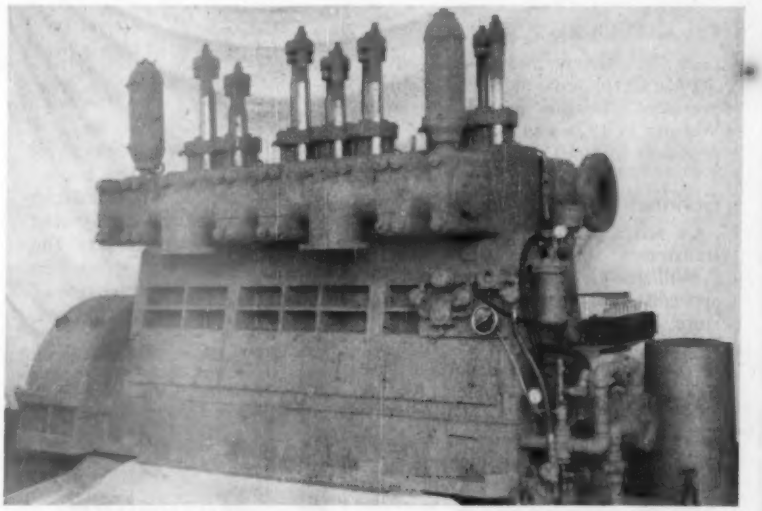
Bowen Itco, Inc., makes a series

. . . of transfers, promotions, and appointments, according to Eldon Osmun, sales manager of the Houston firm.

Changes concern: A. T. (Johnny) Johnson, transferred from manager of the Houston district to manager of the Oklahoma City district; Tommy Farr, appointed manager of the Houston district; Bob W. Evans, appointed field salesman of the Oklahoma City district; Fred McMillian, transferred from Houston to store manager at Oklahoma City; Donnie Davis, promoted from store manager at Casper, Wyo., to district manager at Vernal, Utah; Kenneth Hobbs, promoted from store manager to district manager at Hobbs, N. M.; and Aubrey Teeter, named store manager at Hobbs.

B. R. Wakefield becomes veep

. . . in charge of special projects for Houston Oil Field Material Co., Inc. Prior to joining Homco, Wakefield was with Arthur Young & Co. of Dallas.



SIX-INCH SEPTUPLEX PUMP is one of 30 plunger pumps being furnished by Aldrich Pump Co. for Burmah Oil Co. (Pipelines), Ltd. They will be installed on the 720-mile crude pipeline running from Nahorkatiya, in Assam, to a refinery at Barauni, Bihar. Power and fluid ends were shipped separately to facilitate over-the-road handling.

Bradford Motor Works, Inc. buys

. . . the capital stock of Chas. N. Hough Co., of Franklin, Pa. Both companies manufacture and distribute oil-field-pumping equipment. Plant facilities of the Hough company, now managed by Charles N. Hough, Jr., will be transferred to Bradford, Pa., soon, along with administrative operations.

No change will be made in sales personnel for either company at present and Hough's Tulsa warehouse will be maintained. Bradford's Tulsa branch is managed by Fred Tolley. Sales manager is Stuart Corry.

AiResearch Mfg. Div. appoints

. . . Oil & Gas Supply Co., of Houston, as representative for gas turbines and turbomachinery. The agreement was announced jointly by J. J. O'Brien, manager of Garrett Corp.'s AiResearch Mfg. Division, and Jack Joplin, president of Oil & Gas Supply.

Initial market analysis and technical advice in adaption of AiResearch small gas turbines to gas gathering applications were part of the agreement. Also covered is marketing and pack-

VIKING
ROTARY
PUMP SIZES
to fit your needs
½ To 1050 G.P.M.

½ 35
1½ 45
3 50
5 90
10 100
15 150
18 200
20 300
25 450
28 750
30 1050

- For Thin or Thick Liquids
- Positive, Fast Self Priming
- Smooth Non-pulsating Discharge
- Pressures to 200 psi on heavy duty models —500 psi on hydraulic oils

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VIKING
PUMP COMPANY
Cedar Falls, Iowa, U.S.A.
In Canada, It's "ROTO-KING" Pumps

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aging of off-the-shelf and special design turbine equipment as well as warehousing of spare parts.

The two firms had previously cooperated on several projects utilizing the small gas turbines in oil-field applications.

Dillard Cantrell is promoted

Dillard Cantrell

. . . from chief engineer of Trinity Steel Co., Inc., to assistant to the president—W. Ray Wallace. Cantrell, who formerly served on the engineering staff of Ebasco, has been with Trinity for 5 years.

In his new position he will serve Wallace in broad administrative duties, along with heading LPG sales.

Herbert L. Willke is director

H. L. Willke

. . . of engineering for National Supply Co., following the retirement of Joseph R. Mahan as director of research and engineering. Willke started with the company in 1930 as a field engineer at Houston.

He was transferred to National's Toledo plant in 1935 and was promoted to chief engineer there in 1946. Willke was transferred to the Pittsburgh general offices in 1956 as assistant director of engineering.

Russell E. Ritchie is elected

. . . a director of Stone & Webster Service Corp., announces P. J. Rempe, president. Ritchie joined Stone & Webster in 1926 and was elected vice president in 1950.

Continental-Emsco Co. reports

. . . a series of recent promotions and transfers.

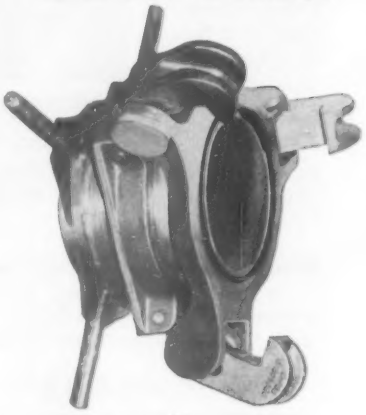
William G. Clark, former D+B specialist, has assumed new duties as store manager of the company's Rangely, Colo., store. Also promoted to store manager at Hadacol Corners, Tex., is Albert N. Taylor, former D+B specialist.

Two store managers have been transferred to new assignments: Carrol L. Gillit, from Hadacol Corners to Andrews, Tex., and Eugene M. Peoples, from Andrews to Houston.

Gerald L. Huddleston, former field salesman, is now D+B specialist at Laurel, Miss. And Walter C. Crow

It's Here! The New, All-In-One Coupling To Make Heavy Hose Connecting A Safe, One-Man Operation

QD-16
COUPLING



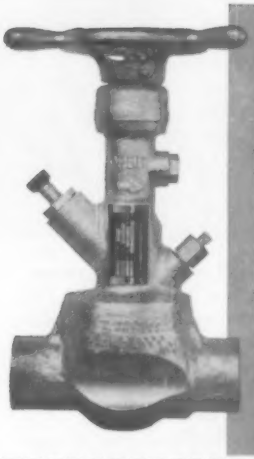
This new hose coupling eliminates the use of bolts, nuts, and can be easily adjusted to accommodate the variations found in foreign counterparts of American flanges.

Brochure on Construction and Operation of the *QD-16 Coupling* is available. Request on your company letterhead.

Flight Refueling, Inc.
COMMERCIAL PRODUCTS SECTION
BOX 1701 - BALTIMORE 3, MD.

THEY'RE NEW for dual and triple completions

ORBIT'S 1¼" RECESSED FULL ROUND OPENING SCREW END PRODUCTION VALVES

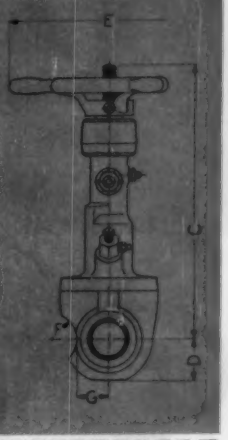


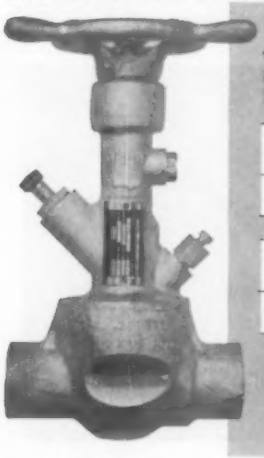
DUAL RECESSED
Fig. No. 4643D
10 Round Thread Upset

6,000 Lbs. TEST
3,000 Lbs. W. P.

SIZE	FIGURE NUMBER	TEST PRESSURE	W.O.G.	A	B	C	D
1¼"	4643D	6,000	3,000	1⅜	8	12⅞	1 15/16

E	F	G	H	J	K	M	NO. TURNS TO OPEN	WEIGHT
9½	1 3/16	1½	—	—	—	2 11/32	10	29 Lbs.



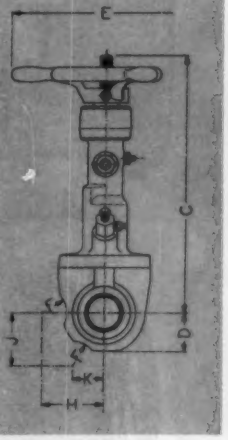


TRIPLE RECESSED
Fig. No. 4643TR
10 Round Thread Upset

6,000 Lbs. TEST
3,000 Lbs. W. P.

SIZE	FIGURE NUMBER	TEST PRESSURE	W.O.G.	A	B	C	D
1¼"	4643TR	6,000	3,000	1⅜	8	12⅞	1 15/16

E	F	G	H	J	K	M	NO. TURNS TO OPEN	WEIGHT
9½	1¼	—	3.105	2.690	1.553	3⅛	10	29 Lbs.



A wide range of sizes and minimum tubing centers are possible by using Orbit Multiple Completion Valves. They are compact in design, sturdy, easy to operate, and shut off tight when closed.

Reduce your surface equipment costs for multiple completions by specifying Orbit Recessed Valves. No lubricant required for a tight shut-off.

Available through all Well Head Equipment Manufacturers and leading Supply Stores. Dual Sizes: 1", 1¼", 1½", 2", 2½", 3", and 4"; 2000, 3000 pounds working pressures. Triple Sizes: 1¼", 1½", 2", 2½"; 2000, 3000 pounds working pressures.

A Minimum Diameter—Opening Thru Valve
B Length — End to End
C Center to Top of Stem — Open
D Center to Bottom of Valve
E Diameter of Handwheel — Overall Swing
F Radius of Body Recess
G Location of Top Body Recess
H Location of Top Body Recess
J Location of Lower Body Recess
K Location of Lower Body Recess
M Tubing Centers
Thread Specifications Conform to A.P.I. Requirements.

ORBIT VALVE COMPANY

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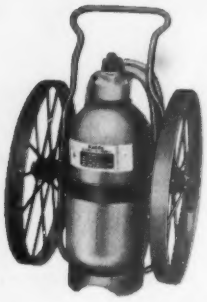
ORBIT VALVES ®

NOW! GET FULL-POWER FIRE FIGHTING WITH KIDDE'S DRY CHEMICAL LINE!

2½ and 5 pound pressurized units! Granted top rating by U.L., these two units pack the extra punch needed to get the jump on fire. For example, the 2½ pound Kidde unit is as compact as a 1 quart carbon tet model, yet is eight times as powerful! Both the 2½ and 5 feature simple, two-step operation, easy-to-read dust-and-moisture-proof gauges. 10 pound dry chemical also available.

20 and 30 pound pressurized dry chemicals! Both these Kidde units have the same good features of the 2½ and 5, plus some "extras" all their own. Center balanced for fast action, rugged diffuser horn, speedy trigger operation, recessed pressure gauge and enclosed mechanism.



200 pound dry chemical wheeled unit! Kidde's 200 pounder discharges a 40-foot stream faster, has an *extra* 50 pounds of fire-smothering dry chemical to knock down fire quicker. Low center of gravity and wide wheels make it easy to maneuver. Easy-to-use discharge control makes operation simple.

400 pound stationary unit! Here's maximum protection in a minimum package! Like all Kidde units, this features sure, dependable performance and fast, easy operation. Either wall-mounted or free standing, leakproof and tamperproof, exclusive Bridgeman Seal, universal long-range nozzle, easy-to-read pressure gauge. 200 pound model also available.

Get the jump on oil, gas and electrical fires! Learn more about the complete line of dependable, efficient Kidde equipment—write today!

Kidde

Industrial and Marine Division
Walter Kidde & Company, Inc.
1054 Main St., Belleville 9, N. J.
Walter Kidde & Company of Canada Ltd.
Montreal—Toronto—Vancouver

goes from district production machinery specialist to division sucker-rod specialist at Midland, Tex.

G. G. Stegall has been moved from district sales engineer to district D+B specialist at Amarillo, Tex.

B. W. (Bill) Wheeler becomes

. . . executive vice president and general manager of McGaffey - Taylor Corp., a wholly owned subsidiary of Eastman Oil Well Survey Co. Wheeler takes to the company over 30 years' experience in California's oil industry.

For the past 14 years he has been with McGaffey-Taylor as part owner, vice president, and field manager. For 20 years he was with Halliburton Co. as assistant divisional manager of West Coast operations.

B. Q. (Jack) Green retires

. . . as staff service engineer of Magnet Cove Barium Corp. after 15 years of service. He will continue in a consulting capacity.

Above, Green receives a service-award pin from President Willard M. Johnson at the company's Houston headquarters.

Green began his career with Magnet Cove in 1945 as supervisor of training for field sales and service engineers. Since 1956, as staff service engineer, he has helped prepare and publish technical bulletins on new drilling-mud materials and engineering techniques. He has served in consulting capacities on mud jobs in the United States, South America, Europe, and the Middle East.

Tube-Kote names new officers

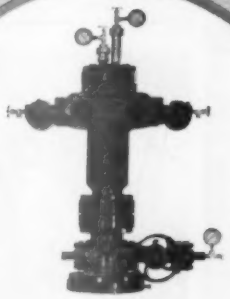
. . . at the annual meeting of its board of directors held recently. J. W. Bozeman was elected board chairman.

Corporate officers named were E. G.

O·C·T HAS THE RIGHT EQUIPMENT FOR LOW PRESSURES, HIGH PRESSURES or any pressure in between.....

ASK THE O·C·T REPRESENTATIVE NEAREST YOU ABOUT A NEW SERIES OF LOW PRESSURE EQUIPMENT

Triple Block Tree

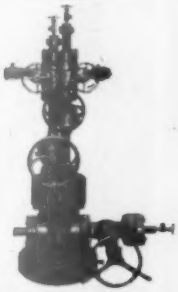


Dual Unitree

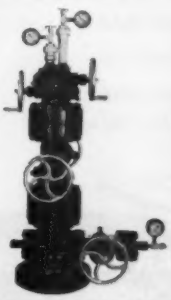
Threaded dual tree with Crescent Flange Bottom

Triple Tri-Flange Tree

Single Unitree



Crescent Flange Tree with Crescent Flow Controls



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Holm, president; J. L. McConn, vice president and assistant treasurer; R. S. Martin, vice president of operations; L. C. Edgar, vice president and technical manager; and I. D. May, treasurer and assistant secretary.

Kirk P. Harger takes over

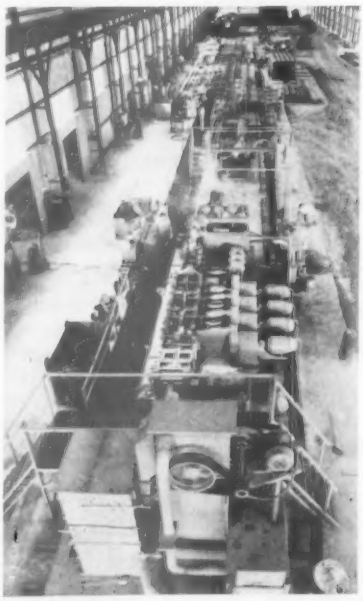
. . . as eastern sales manager of Kerotest Manufacturing Co.'s Steel Products Division, in which job he will be responsible for coordinating sales efforts in the eastern area with plant operations of the Pittsburgh valve-manufacturing firm.

Operating out of offices in New York, Harger will be available for discussion of valve problems which might arise within organizations serviced. He has been with Kerotest since 1956.

George Sandenburgh becomes

. . . manager of sales engineering for Hills-McCanna Co., Chicago. Sandenburgh formerly was assistant superintendent at the company's manufacturing plant in Chicago.

Hills - McCanna manufactures ball valves, diaphragm valves, chemical proportioning pumps, automatic lubricators, and light alloy castings.



NEW PIPE MILL is opened in Houston by Tex-Tube, Inc. The photo shows the entire production line except for coil-handling equipment. The high-speed electric-weld pipe mill is housed in an 80 by 500-ft. steel building.

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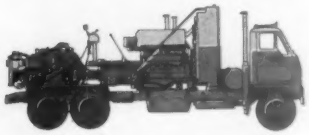

FRACTURING SERVICES

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PRESIDENT of Airdrill International, Inc., Denver, is Robert W. Sneed. The firm was organized to perform feasibility studies and plan air-gas drilling for overseas operators.

Firm specializes in planning air-gas drilling projects

A NEW FIRM, Airdrill International, Inc., Denver, has been formed to specialize in feasibility studies and program planning for air-gas drilling operations outside of the U. S.

Robert W. Sneed, president of the consulting firm, is also a vice president of the parent company, Well Completions, Inc., Denver-based air-gas drilling enginers. "This company," Sneed says of Airdrill International, "could not have been formed 2 years ago, even though air-gas drilling has been growing in use since 1951."

He points out that a rapid spurt in the technology of air-gas drilling has changed the air-gas drilling picture within the last 24 months. Changing conditions in the international petroleum industry increasingly demand maximum economy in dollar expenditures for drilling and development.

Experience in this field. In preparing feasibility studies, the new firm will be able to draw upon the experience and facilities of the parent company and its other subsidiaries. This experience includes supervision and performing more than 1,200 air-gas drilling jobs in the U. S. and Canada.

The practicality of fabricating air-gas drilling equipment overseas can also be evaluated since Well Completions has several years of experience in designing and fabricating specialized compressor packages and auxiliary air-drilling equipment.

Sneed and other members of his consulting group have already made trips abroad to determine the feasibility of air drilling for speedier, more profitable development of oil fields in Latin America. In one noteworthy case, the recommendations were negative, but not for technological reasons.

"In this case," Sneed recalls, "the engineering and geologic factors were such that air might have reduced drilling and completion costs by 50%. But, due to an unfavorable economic and political climate, our feasibility study recommended that air drilling plans be deferred."

Successful application of advanced air-gas drilling technology, whether for a national or a private company, depends on the total environmental conditions in the area. For this reason Sneed believes that air-gas drilling outside the U. S. and Canada will achieve major growth and usefulness within known producing fields.

Given a knowledge of subsurface conditions, air-gas drilling using the latest methods of water control can provide notable savings for companies participating in large scale, multiple-well contracts for exploitation drilling. A second, but important, use of air-gas drilling equipment in these same areas will be in cleaning out and working over older wells.

Two questions immediately come to the minds of those who are told about Airdrill, Sneed's firm: How long will it take to make a feasibility study?

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power Rig No. 2 of Big Chief Drilling Co.

This Magnolia Petroleum Co. well in the old Cement Field of Caddo County, Oklahoma, was drilled to 20,426 ft. by Big Chief Drilling Co. Rig No. 2. The rig's National drawworks is powered through a compound by three V-125 Climax engines with a combined maximum of 1815 hp . . . and a V-125 Climax engine powers each of the two Gardner-Denver PL-7 mud pumps.

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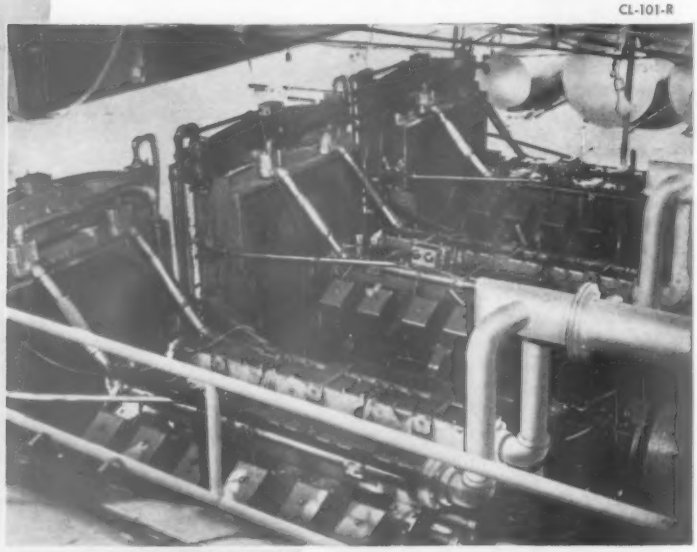

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be given without at least knowing the specific area and the amount of detailed subsurface information available. While engineering and geologic factors can be evaluated relatively quickly, economic and technological feasibility will take some extra time. Since work is performed on a fee-plus-expenses basis, it is equally difficult to preestimate total costs.

"Costs involved in consulting fees," Sneed affirms, "are minor when compared to the potential savings which are possible through an engineered air-gas drilling program covering dozens of wells."

The firm can follow up a favorable feasibility study with the design for an engineered air-gas drilling program, recommending the most suitable equipment, chemicals, and tools. If necessary, the company can supply supervisory personnel for the actual operations. Plans are under way to set up an air-gas drilling school for engineers on a tuition basis.

AIRDRILL-DENVER is the cable address for the new organization. Mailing address is P. O. Box 1356, Denver 1. Offices are at 16080 East Smith Road in Denver.

Sneed is a petroleum engineer from the Colorado School of Mines and he has been associated with well completions and air-gas drilling since 1954. A member of the Society of Petroleum Engineers of AIME, he has written several technical articles.

AAODC fetes two

TWO PROMINENT oil-well drilling contractors were presented plaques today for their outstanding contributions to the AAODC.

W. C. Fatjo, owner of W. C. Fatjo Drilling Co., Lafayette, La., was honored for the outstanding chapter activities of the Lafayette Chapter of AAODC of which he served as chairman during 1960.

Jas. H. Phillips, Jr., president of King-Phillips, Inc., Fort Worth, was cited as the outstanding chapter chairman for 1960. He has headed the Fort Worth Dallas AAODC Chapter. The awards were presented at the twentieth annual meeting of AAODC in New Orleans.

Alaska permits gain

TOTAL NUMBER of drilling permits in the State of Alaska have increased this year. There have been 20 issued to date during 1960, while during the total 12-month period of 1959 only 16 drilling permits were issued. It is likely that another five will be issued before year end, which signifies the growth in the state's drilling.

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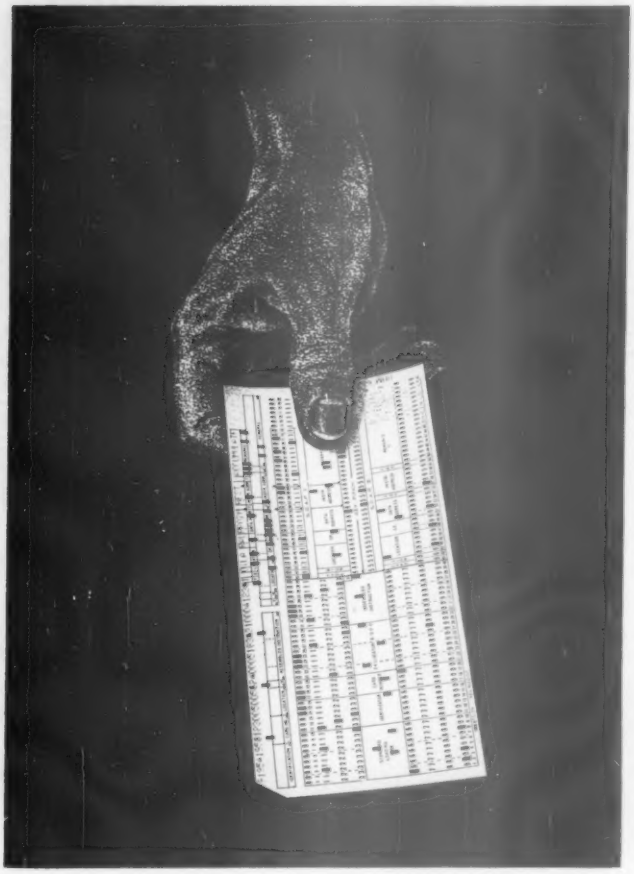

this well is misbehaving

One of the most significant and directly useful "products" of Core Lab's new *CAP* service — COMPUTERIZED ACCOUNTING OF PRODUCTION — is the reporting of abnormal well behavior.

Not only does *CAP* deliver complete, tailormade production summaries (by zones, wells, batteries, leases, fields, and interests) but special reports can be issued when variations occur in well test, production, or injection characteristics. The client specifies the tolerances when his program is designed. *CAP* takes it from there. It's quick and simple, accurate and economical.

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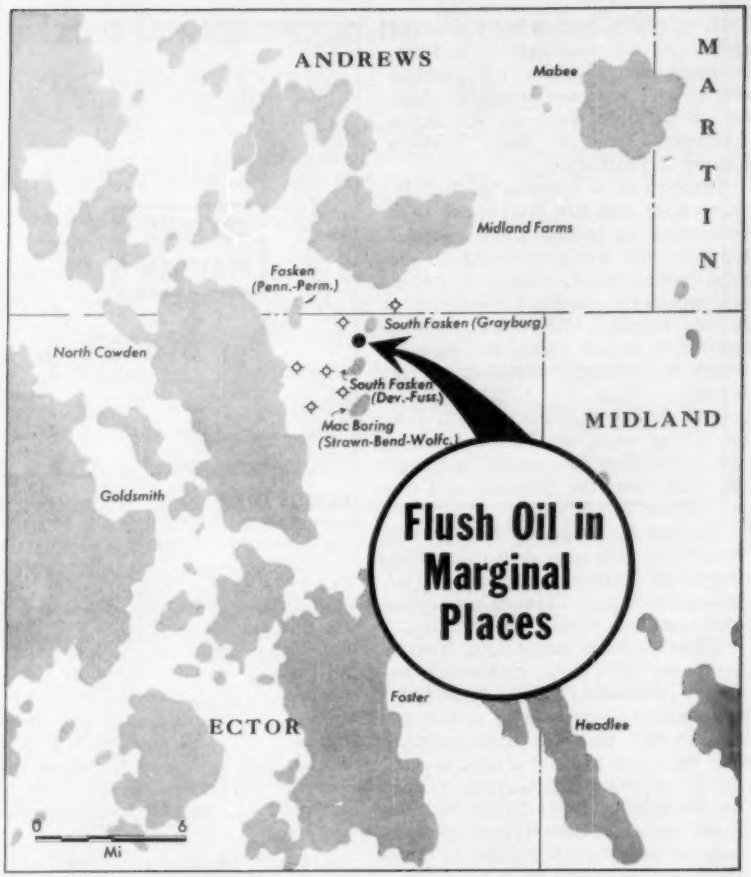
BY FRANK J. GARDNER

West Texas strike hits three pools —maybe five



A TRIPLE-PAY PRODUCER with a total capacity of about 1,000 bbl. per day on restricted choke has been completed in the northeastern Ector County, West Texas. It is surrounded by marginal fields and dry holes.

WEST TEXAS last week had one of its most interesting wildcat strikes in some time. Regionally, it's surrounded by some of the most famous fields in Texas. Locally, it sits half way between two of the poorest.

Anderson-Prichard Oil Corp. drilled the discovery, 1-14 Fasken unit, in Section 14, Block 42, T-1-N, T & P Survey, in the northeastern corner of Ector County, 14 miles northwest of Odessa. Here, in an area of marginal production from two or three old fields, there was little indication of "big oil" yet to be found.

A second look. But Apco decided to chance it with a 13,000-ft. wildcat, following a seismograph survey which revealed a structural uplift not previously known. The 1-14 was spudded last May. Last week, it was finished as a triple producer, with two additional pay horizons sealed off for future exploitation.

Beginning at the bottom of the hole (total depth 13,015 ft.), Apco completed in the Ellenburger (Cambro-Ordovician) for an open-hole (12,983-13,015 ft.) potential of 441 bbl. daily on 18/64-in. choke; gravity of the oil is 54°. A second completion was made in Wolfcamp (Permo-Penn) through perforations at 8,475-95 ft. for 189 bbl. of 41° oil per day on 14/64-in. choke. The third reservoir was added when Apco potentialed the well in Fusselman (Silurian) pay at 12,220-50 ft. for 352 bbl. daily on 15/64-in. choke; gravity here was 48°. Total restricted capacity of the well stands, then, at about 1,000 bbl. per day.

Brings a surprise. "Besides these three," says Bill Brodrick, Apco geologist, "we feel there may be commercial zones in the Strawn (Pennsylvanian) and in the Devonian, but these will be examined in later wells." Drill-stem test of the Strawn in the 1-14 did recover some free oil, but the Devonian was not tested. "As usual," says Brodrick, "we were hopeful for even one commercial pool, but it was really a pleasant surprise to find three, and possibly five!"

Apco now plans to drill a southwest offset to the discovery, but spudding must await final approval and arrangements.

Earlier discoveries in the immediate vicinity of the Apco 1-14 proved to be marginal operations. South Fasken-Grayburg field, about a mile northeast of the new discovery, is a one-well pumper with Permian pay at 4,777 ft.; it is now making about 4 bbl. daily. It was found in October 1958, by Pan American Petroleum Corp.

About 1¼ miles to the southwest of the new well is a dual-completion one-well field known as South Fasken-Devonian and Fusselman; this one, also a Pan Am operation, is on marginal production of 30 bbl. a day from Devonian at 11,540 ft. and 15 bbl. a day from Fusselman at 12,270 ft.

Such discoveries as this should not go unheralded. For they clearly demonstrate that there's a lot of unfinished business in exploration of our older producing areas. One mile can make a lot of difference, horizontally—or vertically.

California offshore oil search may pay off

THE SEARCH for oil off California apparently has paid off for a three-company combine which plunked down $23.7 million—an industry high for an offshore tract—in winning a 3,840-acre lease off Santa Barbara County 2 years ago.

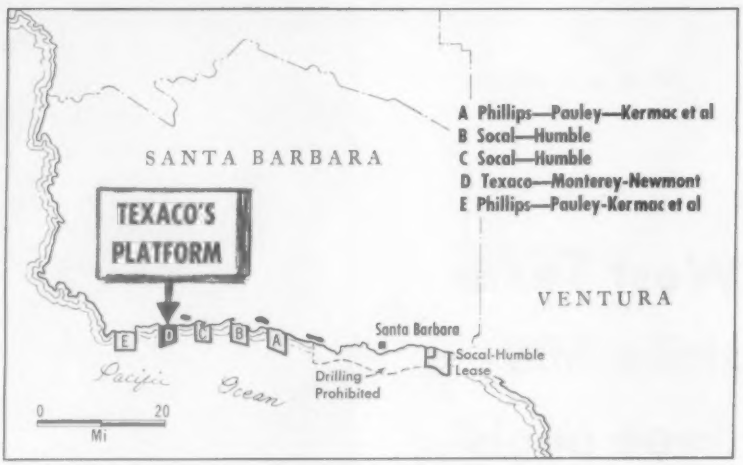
Texaco Inc. is operator on the offshore tract and has been more than cautious about releasing any information on what has been found on the high-priced block. However, earlier this month the company revealed it is drilling below 2,172 ft. on the first well from a new platform, "Helen," which was recently installed on the lease.

This drilling progress report is Texaco's first word on Parcel D since July 1958 when the company acquired the lease along the Newmont Oil Co. and Monterey Oil Co.

The company reportedly drilled two wells from a floating drill ship which flowed at a rate of 1,393 bbl. of 35°-gravity crude daily. Texaco has neither confirmed nor denied the reports.

There is little doubt that Texaco has come up with a commercial discovery off Santa Barbara. In addition to spending upwards to $3 million for the 28-well platform, the company also has plans to build a natural-gasoline plant onshore at Gaviota to handle production from Parcel D. The Santa Barbara County Planning Commission approved plans for the plant early this month.

The well (3 Texaco State PRC 2,206.1) being drilled by Texaco is approximately 1½ miles offshore from Gaviota in 95 ft. of water. Caldrill, Inc., is contractor on the well.



THERE IS LITTLE DOUBT in California minds that Texaco Inc. has come up with a commercial strike off Santa Barbara in the Pacific tidelands.

Other activity. Texaco and its partners apparently are enjoying more success off Santa Barbara than the other operators who won acreage at the 1958 lease sale. Parcel D is one of five 6-sq.-mile tracts leased at the sale.

Some drilling has been done on four of the five tracts and only one of these operations may pan out. However, little has been released on any of the wells since all are tight holes.

Phillips Petroleum Co. may have established production on Parcel A, the most easternly block of the five. Phillips has drilled five holes on the block. The last well was drilled to 8,871 ft. from an onshore location. It is standing cemented with 7-in. casing to 8,858 ft., but no additional drilling has been announced.

Phillips is operator for itself, Pauley Petroleum Co., Kerr-McGee Industries, Inc., and 30 other companies and individuals. Parcel A was the second-most-expensive block of the five, bringing a top bid of $13,550,000. This combine bid $22 million for the Texaco-Newmont-Monterey block.

Standard Oil Co. of California and Humble Oil & Refining Co. have drilled a dry hole on Block B and several wells on Block C. Socal, the operator, says the wells on Block C are "inconclusive and somewhat discouraging."

The Phillips-Pauley-Kermac combine is scheduled to start drilling in November on Block E. The operator will move an offshore platform in on this lease, which has more severe wind and wave conditions during much of the year than the other tracts.

Lease sale. Interest is high in the drilling off Santa Barbara since the State Lands Commission is scheduled to hold another lease sale for open acreage some time late this year or early in 1961.

Shell Oil Co. has nominated the land between the five blocks for leasing and the commission has added some additional acreage to run the total available to about 50,000 acres. The open acreage runs from Point Conception east to about 8 miles west of the city of Santa Barbara.

The state is expected to announce within a few weeks the leasing procedure planned for the sale and the date of the sale.

The five blocks leased in 1958 were awarded under cash bonuses. The state also has a sliding-scale royalty rate which begins at 16⅔%. A similar pattern will probably be followed at the next sale, but there has been some operators who favor a straight royalty basis for bidding.

It is doubtful that all the land open for leasing will be put up at the next sale, but just how much will be offered has not been determined.

Drilling. The only other drilling off Santa Barbara County—and virtually off California—is being done by Socal and Humble at its Summerland lease about 20 miles down the coast from the five parcels.

Two platforms are working on the Summerland lease. The operator has completed 11 producers and 5 dry holes on the tract. The two platforms off Summerland and the new Texaco platform are the only ones operating in California tidelands.

The only other offshore drilling is being carried out on two drilling islands, one a Richfield operation at Rincon Island off Ventura County and the other by Monterey at Seal Beach off Orange County.

Three new pools opened in Kansas last week

There are three new discoveries in Kansas—in Stafford, Sumner, and Cowley counties.

Chief Drilling Co. completed 1 Kipp in Stafford County, NW SE NE 20-25s-13w, for 150 bbl. oil per day from Arbuckle Cambro-Ordovician. Perforations are at 4,337-42 ft. The well opens North McCandless field.

Don Slawson opened Holman pool at 1 Holman in SW SW NE 26-33s-2e, Sumner County. The Mississippian producer at 3,306-12 ft. got 170 bbl.

of oil per day. Location is in the southern part of the county.

Gearhart-Canaday Drilling Co. et al. 1 Smith opened South West Rock pool in Cowley County. The well, located in SW SW SE 26-31s-3e, made 50 bbl. of oil daily from perforations in the Layton sand at 2,497-2,500 ft. This discovery is located 1½ miles north of Weathered pool and 2½ miles southwest of Akron, Kansas.

Morton County. Cities Service Co. has an apparent strike in southwestern Kansas at 1 Sutton "A" in C SE NW 33-34s-41w.

The well flowed gas on drill-stem test of the Morrow Pennsylvanian sand at 4,864-85 ft. Location is 1 mile east of Wilburton gas field and 6 miles north of the Oklahoma State line.

Seward County. A new pay was opened in South Kismet field at Thomas & Brewer Oil & Gas Co. 1 Eaton in C NE SE 27-33s-31w.

The well flowed 3,450 M.c.f.d. from perforations in the Council Grove Permian sand at 3,072-3,112 ft. Previous oil and gas in this area is in the Mississippian.

Clark County. J. P. Booth et al. completed a confirmation discovery in Sitka pool, southwestern Kansas. The 1 Swayse in C NE 23-33s-22w, southwest offset to the field discovery, flowed 5,250 M.c.f.d. from perforations in Morrow at 5,322-29 ft. Discovery well, Sinclair and Booth 1 McMinimy, C NE SE 13, flowed 11 M.M.c.f.d. from Morrow at 5,266-72 ft.

Hodgeman County. Two wells were added to producing areas in this county. Colorado Oil & Gas Corp. completed two Mississippian oil wells in West Wieland field.

The 3 Antrim in C NE NW 18-21s-22w made 202 bbl. of oil daily on pump from perforations at 4,368-92 ft. The 2 Crossman in SE NW NW 18-21s-22w pumped 146 bbl. of oil per day from perforations at 4,362-80 ft.

Roswell geologists to tour S. New Mexico

The Roswell Geological Society announces a field trip November 18-20 to the San Andres and North Franklin Mountains to study environments of deposition of Pennsylvanian rocks in southern New Mexico.

Registration begins November 17 at the Holiday Inn in Las Cruces. All geologists interested in the principles of sedimentation of clastic and carbonate rocks are invited to investigate in detail the environments and deposition of the Pennsylvanian rocks of the Orogrande basin. The delegates will have an opportunity to walk over three important Pennsylvanian sections. Sections to be seen are critical to an estimation of the oil and gas prospects in the Tularosa and Jornada del Muerto basins which are currently on the frontiers of the oil industry in New Mexico.

For registration blanks, contact Roswell Geological Society Field Conference, Box 6732, Roswell, N. M.

Next Week:

Latest Developments in the Pipeline Industry

THE MAIN ATTRACTION of the Journal's Annual Pipeline Issue will be a special section on Mid-America Pipeline Co.'s gigantic LPG system from the Southwest to the upper Midwest.

Here you will learn about the policies, design, engineering, construction, and operation of the first major LPG line ever built.

Other important features in the October 10 issue will include:

- Instrumentation for more precise control of petroleum pipelines.
- What's needed in pipeline pipe.
- Remote-controlled gas-turbine stations.
- Modernizing a products line for greater efficiency.
- New approach to interface detection by measurement of dielectric constant.

Watch for this important issue next week.

Eastern Kentucky wildcat hits dust

In Carter County a rank wildcat, John Porter 1 Huber is dry and abandoned. Located on Grassy Creek in the southeast quarter of 7-X-77, the test topped Berea sand at 439 ft., Corniferous lime at 945 ft., and Silurian red shale at 1,200 ft. Well was drilled to a total depth of 1,206 ft. No shows were encountered.

Cambrian pays at second Nebraska field

Nebraska has its second Cambrian producing area. Franco-Central Oil Co. completed 1 Fritz in C NW NW 1-2n-27w, Redwillow County, to open the second such producing area this year.

Pump gage at the new pool opener was 95 bbl. daily from Reagan sand perforations at 3,517-24 ft. Location is 1¼ miles south of Sleepy Hollow field, the state's first Cambrian producer. A west offset to the Sleepy Hollow discovery and likewise for the new Franco-Central well will be completed soon. Operators for these important confirmation tests are Midwest Oil Corp. and Pubco Petroleum Co., respectively.

Medina sand flows at record rate

IN PENNSYLVANIA, a significant wildcat discovery was completed in Crawford County on the J. Lehman farm. Operator is George Hall et al.

The well had the largest initial open flow from the Medina sand of any well completion in that zone in the state. Operator completed without fracturing at an open flow of 6,200 M.c.f.d. and a rock pressure of 1,100 psi. The first gas was found at 3,580 ft. Total depth was 3,600 ft.

A second wildcat was completed with an open flow of 1 M.M.c.f.d. This is the State Game Land Tract 43, No. 3, which was reported in April as a new discovery for Felmont Oil Co. on the Laurel Hill anticline. After considerable delay, the well was finally completed as a gasser in the Lower Devonian.

A fourth producer has been completed in the Ohiophyle field of Fayette County. The operator, Manufacturers Light & Heat Co., completed 2 Mueller-Herr at a depth of 6,694 ft. The final open flow after fracture was 10 M.M.c.f.d. with a rock pressure of 3,450 psi. in 14 hours.

Three producers and four dry holes were completed in the Boone Mountain and Rockton pools of Clearfield County. Potter and Erie counties each had a development gas well completed in September.

Abstracts show southwest petroleum prospects

RECENT BELL CANYON EXPLORATION IN THE NORTH DELAWARE BASIN

BY MARCH W. NOTTINGHAM

The upper Bell Canyon reservoir sands of the North Delaware basin are very fine-grained, arkosic sands cemented with small amounts of carbonate. Their blanket distribution and sedimentary textures suggest a depositional medium such as density currents.

The geologic history at one stage seems to have involved a predepositional sorting of the sand before its final transportation across the North Delaware basin. The reservoir sands exhibit a uniformity in texture, and mineralogy that might allow them to be termed "blanket," even though they do not exist with uniform thickness throughout the basin. This thickness varies from 0 to approximately 70 ft., having a cross-sectional shape characterized by a concave base and a flat top.

The location of these sand bodies seems to be determined by local subsidence or compaction of the sediments. The fact that these sand bodies are frequently not continuous over the local adjacent highs, gives rise to the trap mechanism of the reservoir. A favorable hydrodynamic condition may also be increasing the efficiency of the trap. Evaluation of the reservoir section is greatly enhanced by core analysis and the gamma ray-Sonic Log.

The two most prominent fields in the North Delaware basin are the North Mason and El Mar fields, the former being in existence since 1952 and the latter since early in 1959. Their average reservoir characteristics are very similar: porosity 24%, permeability 25-45 md., oil saturation 13%, and water saturation 44%.

Wells can be drilled for as little as $20,000 depending on the depth required in a given location in the basin. Accumulative production to date is approximately 7,500,000 bbl. for the entire Mason and North Mason fields over 8 years and 950,000 bbl. for the entire El Mar field over a 1-year period.

Deeper possibilities exist throughout the 4,000 ft. of the Delaware Mountain group, as well as in the pre-Permian sediments. Future discoveries are imminent, for well density is increasing each month. This allows better evaluation of each new test, thereby giving rise to more realistic acreage appraisals.

To be presented at Southwestern Association of Geological Societies, Abilene, October 1960.

OIL ACCUMULATIONS ALONG ABO REEFING, SOUTHEASTERN NEW MEXICO

BY W. J. LeMAY

DURING Abo (Lower Leonard) time, clastic deposition in the Delaware basin was separated from the lagoonal deposits on the Northwest shelf by a transgressive barrier reef.

A lithologic study within the Abo formation reveals facies changes from shelf to reef to basin. Shelf, or backreef deposits, consist of interbedded green shale and light gray to tan, fine crystalline, anhydritic dolomite. The interfingering of shelf and reef dolomites form an effective permeability barrier to the migration of fluids backreef.

The Abo reef is a clean, white to light-tan anhydritic, fine to coarse crystalline dolomite, exhibiting secondary porosity development due to fracturing and solution activity. Interconnecting vertical fractures and vugs give the reef excellent reservoir characteristics which would otherwise be absent in the tight reef matrix. Basin deposits (forereef) include black to dark-brown argillaceous and cherty dolomites and limestones interbedded with fine-grained sandstones. Forereef deposits are called "Bone Spring formation" and are believed to be Abo equivalent.

Hydrocarbons have been trapped where porosity has been well developed in relatively high structural areas along the reef. At present there have been five Abo-reef fields discovered in New Mexico: (1) Lovington Abo, (2) Corbin Abo, (3) Empire Abo, (4) Turner Abo, (5) Woolley Abo (the latter two are recent discoveries and the lease names are used for designation purposes).

The size and reserves of these fields are dependent upon the following factors: (1) Thickness of reef above water, (2) structural configuration of the reef, (3) quality of the reef pay. The productive limits of an Abo reef field are defined by each field's respective water table. In the case of the Lovington and Empire Abo fields, production is limited backreef by interfingering of reef and shelf dolomite forming an effective permeability barrier.

A successful exploratory procedure has been to estimate a well's proximity to the reef crest by defining its relative stratigraphic position through correlation with areas of close control which traverse the reef.

Remote Williston well tops Ratcliff pay

RATCLIFF Madison Mississippian production is reported at an important wildcat in northeastern Montana's Sheridan County.

Discovery well is Signal Drilling & Exploration Co. 1 Anderson in C SE SW 13-32n-58e, 2½ miles northwest of Dwyer field. The well flowed at the hourly rate of 10 bbl. oil with some water from acidized notches at 7,749 and 7,775 ft. in the Ratcliff zone. There is no drilling between the Dwyer field and the new wildcat.

Ivanhoe field. Triple completion is reported at Ivanhoe Dome field in Musselshell County, Central Montana.

Champlin Oil & Refining Co. 3 NPRR, C NE NW 17-11n-31e, is producing from Amsden, Tyler A, and Tyler B sands. These pays have produced at other wells in the field but this is the first triple discovery. Morrison Jurassic is also a field pay.

Flow was 15 bbl. per day from the Amsden at 3,461-66; 95 bbl. from Tyler A sand at 3,956-68; 63 bbl. of oil and 22 bbl. water daily from Tyler B sand at 4,029-33 ft. This is the third Amsden producer for the field.

Pettus area of Texas' Plummer field is reactivated

The old Pettus-sand sector of Plummer field, in northwestern Bee County, of Texas' central coastal region is being reactivated by two new wells. One is completed in the area's long-abandoned Pettus at 3,000 ft. The other is in a shallow sand at 1,800 ft., possibly in the Frio-Vicksburg section.

Both wells were drilled as joint operations of Hugo Allen and M. J. Mitchell. The Pettus well, 1 William H. Welkener, has an open-flow potential rating of 4,100 M.c.f.d. of gas with pay perforated at 2,964-68 ft. It is off the northwest side of the old Pettus producing area.

The other well, 1 A. J. Smith, is good for 7,400 M.c.f., open flow. Pay is perforated at 1,807-11 ft.

The Pettus sand sector was opened in 1935. More than 20 wells have been completed but none has produced for several years. The area is just west of the field's deeper Wilcox sector, still active.

EXPLORATION OUTLOOK

Geologists take to the field-trip hills

Annual field trips underway
as rockhounds tour these important areas
Montana's Quake Lake
Nevada's Great Basin
New Mexico's Chama Basin
New Mexico's & Texas' Delaware Basin
Oklahoma's Ozark Dome and Arkoma Basin

EACH AUTUMN, office-weary geologists begin looking at the calendars and road maps tucked away in their top drawers. To many this sudden stir out of August Dog Days means vacation; to others the stir has a dual purpose—vacation and annual field trips of the various geological societies around the oil provinces. The interest in these yearly field conferences has increased multifold in the past few years. Each year finds each society doing a better job than the year before. Attendance is no longer restricted to local geologists.

The 1960 fall season for geologists

. . . should prove one of the most interesting yet for those who like to see geology at work. The first of five conferences began September 7 in the Hebgen Lake-Madison Valley (Quake Lake) area of Montana and will end October 16 in New Mexico's Chama basin. Of the five trips planned this fall, two will take geologists into oil and gas-barren basins—the Chama and Madison Valley. The other three excursions will give rockhounds a look at two of the most important oil and gas basins of the future in the nation plus a trek through the one-field vastness of the Great Basin in Nevada.

The Great Basin of Nevada

. . . was visited by the Intermountain Association of Petroleum Geologists and Eastern Nevada Geological Society in September. Though the basin covers parts of five large western states, there is only one oil field—Eagle Springs in Nye County, Nevada. Great Basin remains as one of the country's least-tested future provinces for oil. This trip was of extreme value to the literature on a vast region of complex and diversified geography and geology. Interest in the trip was further amplified by the announcement of Richfield Oil Corp.'s planned wildcat in the Elko area.

Last year's Montana earthquake

. . . was the scene for the Billings Geological Society tour in September. Rocky Mountain geologists got a first-hand billing on the tremendous quake that changed the local area around West Yellowstone—damming a river, creating a lake, revealing the still-active diastrophism of the Rockies.

Still to come

. . . is the New Mexico Geological Society's probe of the Chama basin—a small, dry bowl lying between still drier Raton and the big gas and oil fields of San Juan. New Mexico, like Wyoming, is a state of many basins. But New Mexico, unlike Wyoming, still has many dry ones to tap.

West Texas geologists

. . . joined their New Mexico neighbors in evaluating one of the biggest oil teasers of them all—Delaware basin. This has been the oil year for this large basin. Deep discoveries out in heretofore barren areas appear to be the first step in cracking this Texas wildcat barrier.

Northeastern Oklahoma's Arkoma basin

. . . drew the interest of Mid-Continent geologists when the Kansas Geological Society held its twenty-fifth annual field conference in this newly important gas province. Recent gas discoveries throughout the Arkansas and Oklahoma portions of the basin point it up as one of the region's top contenders.

—John C. McCaslin

Prolific Morrow discovery finaled in Oklahoma Panhandle

Potential tests indicate a big Morrow Pennsylvanian producer for Oklahoma's Beaver County. The discovery well is Oklahoma Natural Gas Co. 1 Robertson in C NE NE SW 16-2n-28eCM, 11 miles northeast of Logan and 3 miles south of Mocane-Laverne field.

Flow was 6 M.M.c.f.d. during tests at 7,624-7,708 ft. Flow was 1,180 M.c.f.d. plus 120 bbl. of oil in 9 hours on final potential from upper Morrow sand at 7,646-7,667 ft. Lower Morrow at 7,742-49 and 7,793-7,809 ft. got 1,720 M.c.f.d. plus 16 bbl. condensate in 6 hours.

Oklahoma's Kingfisher boom picks up two more oilers

The continual stream of good oil wells in Kingfisher County added two more last week. King-Stevenson Oil Co. Inc. and Calvert Petroleum Co. completed 1 Hall as a new field well for Middle Dover pool in C SW NE 27-18n-7w. This field is now linked with North Dover field. Initial flow on various chokes was 350 bbl. of oil in 12 hours from Manning Mississippian openings at 7,047 and 7,059 ft.

Humble Oil & Refining Co. completed a dual producer in East Hennessey field, the fastest growing pool in the play. The 1 Bohomill Shimanek, C NE SW 9-19n-6w, flowed 120 bbl. of oil in 6 hours from the Manning at 6,593-6,628 ft., or 408 bbl. per day. From the Mississippian zone it made 27 bbl. in 5 hours or 130 bbl. daily at 6,808-6,965 ft. Choke on upper zone was 20/64-in.; lower zone was 18/64-in.

Okfuskee County. An eastern Oklahoma wildcat discovery was completed by Toto Gas Co. at 1 Fink in SW NE SE 17-10n-10e.

The well flowed 2 M.M.c.f.d. from Hunton Siluro-Devonian open hole at 3,738-55 ft. Location is 1 mile north of Scott pool and 1 mile west of Northeast Scott pool.

Oklahoma Panhandle well reports high oil flow

A well in East Postle field, Texas County, Oklahoma, flowed 416 bbl. of oil per day on 28/64-in. choke. It is Republic Natural Gas Co.'s 6-M Blake in C NW NE 11-5n-13eCM. Production is from perforations at 6,102-12 ft. in the Morrow Pennsylvanian.

Grant County. Tidewater Oil Co. completed 1 R. H. Edsall in C SE SW 4-27n-7w, Southwest Wakita field, Grant County, northern Oklahoma, flowing 372 bbl. of oil daily on 1½-in. choke from Red Fork Pennsylvanian perforations at 4,999-5,009 ft.

Alfalfa County. Driftwood and Southwest Byron fields in northern Oklahoma were linked with completion of Atlantic Refining Co. 2 W. H. Davis in C NW NW 25-28n-11w.

The well flowed 192 bbl. of oil per day on 12/64-in. choke from perforations in the Cherokee Pennsylvanian at 5,005-11 ft. Southwest Byron field was recently linked to the Wakita trend. This trend is now 30 miles long east-west across the northeast part of the county and is one of the most prolific areas in Oklahoma.

Keystone state may have new oil law

The oil and gas producers of Pennsylvania met recently in Harrisburg to discuss the possibility of an oil and gas-conservation bill.

At this meeting, a committee was appointed to review an old bill which had been presented to the legislature the year before but never got out of committee. The conservation committee held several meetings and then submitted a draft of the proposed conservation bill to the oil and gas producers. On September 8 the draft was reviewed and discussed by the oil and gas producers, and returned to the committee for corrections. It is hoped that this proposed bill will be ready in time to submit to the legislature by the first of the year.

Confirmation tried for deep Texas well

Confirmation of ultradeep Edwards production discovered earlier this year in the Word area of Lavaca County, South Texas, is being attempted in a projected 15,000-ft. test a half mile west of the significant discovery well.

It is the first test started in the Word area since the discovery well was completed. Socony Mobil Oil Co., operator on both wells, has location on its Jim Orsak 39-acre lease in the James Kerr Survey.

Discovery well, 1 Sylvia W. Kahanek, completed last April, was productive of gas and condensate with pay at 13,320-14,278 ft. It tested good for 3,600 M.c.f.d. of gas with a gas-liquid ratio of 14,200 cu. ft. per bbl.

The discovery extended the "Deep Edwards" trend of field nearly 60 miles northeastward along a line 30 to 35 miles coastward and downdip from the much older and shallower Balcone and Luling fault-zone trend of Edwards-productive fields. Pay zone is the second deepest at which the Edwards lime has proved productive so far.

Palo Pinto is new pay for Texas' Hardeman

Hardeman County in the northwestern corner of North Texas has a new producing horizon—the Palo Pinto lime. Discovery well is Shell Oil Co. 3 C. G. Conley in Section 81, Block 8, W&NW Survey.

The new well, 8 miles west of Chillicothe, is the third producing well for Conley field and the first such production in the county. The well flowed 182 bbl. of oil on 10/64-in. choke from perforations at 5,210-40 ft. Gravity is 40° with gas-oil ratio at 331:1. The well also flowed 200 bbl. of oil per day on 48/64-in. choke from perforations in the Mississippian at 7,861-7,971 ft. Gravity is 44° and gas-oil ratio at 150:1.

Blair sand is new Green River pay

The Blair sand is a new pay zone for Wyoming's Green River basin. Blair is a member of the Mesaverde Cretaceous. Gas flowed from both the Rock Springs and the Blair at Mountain Fuel Supply Co.'s 1 Jackknife Springs unit in SW NW 11-16n-101w, Sweetwater County.

An earlier test in the Almond Mesaverde got gas also. The Rock Springs test at 4,910-5,060 ft. got 4,500 M.c.f.d. Flow from the Blair at 5,345-75 ft. was 4,500 M.c.f.d. There is very little Rock Springs production in Wyoming—it being at Canyon Creek and Trail unit fields.

Two Alaska wells slated for Cook Inlet

Alaska will permit Union Oil Co. to drill two oil wells at the north end of Cook Inlet in the Knik Arm development area, 20 miles north of Anchorage by air. Depth will be 3,000-3,500 ft. Spudding was slated for late September.

It should only take about a week to drill each well. If oil is found at this shallow depth, it will mean a fast development for the area. Ohio is in with Union in the Knik contract. The contract was approved last February by the Department of Interior. It is a joint venture to explore 229,000 acres on the east side of the Susitna River Drainage near Wasilla, Palmer, and Big Lake. Tri-Cities Drilling Co. of Edmonton will drill the shallow holes with a truck-mounted rotary. Union

has done considerable geophysical work in the area. Location of the 1 Knik Arm well is 17 miles southwest of Wasilla in 2-16n-4wSM. The No. 2 well is 14½ miles southwest of Wasilla in 5-16n-3wSM.

South Arkansas gets strike

Cotton Valley has proved productive in a new discovery by Olin Oil & Gas Corp., in southwestern Bradley County, southern Arkansas.

Discovery well, 1 Brunson, in 2-17s-12w, is 4 miles southeast of Moro Bay, and near the Union County line. It is one of the most easterly points in southern Arkansas where Cotton Valley production has been found.

Pay in this well is perforated at 3,381½-90½ ft. The well flowed at the rate of 120 bbl. per day in early tests through 12/64-in. choke with pressure of 400 psi.

The discovery opens Careyville field. It is less than a mile southeast of River Bend field, but its discovery—and so far only well—a small pumper completed a year ago, is productive from Meakin sand at 2,569½-73½ ft.

Olin is a partner with Austral Oil Co., Inc., in the confirmation of another recent southern Arkansas Jurassic discovery. Their 2 Olin International Paper Co., a mile east of their discovery well of Lake Erling field, in Lafayette County, flowed 2,500 M.c.f. of gas and 322 bbl. of 54.4°-gravity condensate per day from Smackover lime, perforated at 10,971-95 ft. Pressure registered 3,630 psi.

Their discovery well, 1 Olin, completed last March, also was a rich gas-condensate well with pay perforated at 11,005-25 ft. Its flow was tested at 384 bbl. of condensate and 2,784 M.c.f.d. of gas through 27/128-in. choke.

Lake Erling is westward across the state from the new Careyville field. It is less than 3 miles north of the Louisiana line, and the old Carterville field.

Saskatchewan adds eighth oil strike

Kissinger Petroleums, Ltd., has indicated Saskatchewan's eighth oil discovery this year renewing interest in an all-but-forgotten region in the southeastern corner of the province.

The new strike, only 4 miles north of the U. S.-Canadian International boundary, is another Mississippian pool discovery. It will certainly attract a certain amount of followup drilling to develop it and while it is limited to some degree to the west by abandonments, the area to the east and southeast is relatively untested.

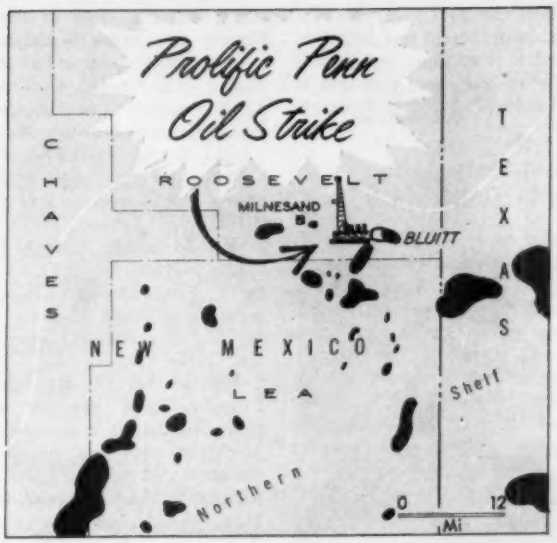
This strike, Kissinger 9-19-1-31 Carievale, was drilled on LSD 9, 19-1-31w1. It is 6 miles southeast of oil production in Carnduff pool, 1¾ miles northeast of marginal success in the Elmore region.

Kissinger, a firm that has been carrying out operations in Canada for the past few years, last year alone drilled 27 wells in Saskatchewan and found success at 22 of them.

The new discovery was drilled on lands acquired under farmout from Imperial Oil Ltd. and including those, Kissinger has approximately 1,500 acres in the vicinity of the well.

Pay. Discovery horizon was reported as the Frobisher evaporites, or Mission Canyon. A pair of drill-stem tests in a porous sector, found some 50 ft. below the top of the formation, were tested and both gave recoveries of water-free crude. A total of 59 ft. was covered by the test and the best recovery was attained during the second when 2,300 ft. of clean, gassy oil was found in the pipe. Porosity was encountered at 3,884 ft. and production casing has now been run to total depth 3,957 ft.

Saskatchewan's southeastern sector play is entirely based on the Mississippian formation. And while there are many major-sized fields with good producibility it has occurred over the past 2 years that the industry is slowly running "out of zone." Most of the promising productive areas have been drilled and either have found oil or have been disproved. Another problem facing the industry in this province and Manitoba to the east is the salt water intrusion in most of the fields, which is increasing steadily. However, there are still a few promising regions to be drilled and that could be pointed out no better than by the recently drilled Kissinger strike.



HERE is a prolific Pennsylvanian discovery in Roosevelt County, New Mexico. This northern basin shelf strike flowed 282 bbl. of 47°-gravity oil in 6 hours through 28/64-in. choke for a calculated daily rate of 1,128 bbl. from perforations at 9,653-72 ft. Location of Cosden Petroleum Corp. 1-C Federal is in 20-8s-36e, 4 miles southeast of the town of Milnesand and 4 miles west of Bluitt Pennsylvanian field.

Deep Illinois basin wildcat flows oil

In Jefferson County, Illinois, Sun Oil Co. et al. 1 Robert W. Aydt is drilling at 5,009 ft. This deep wildcat, SW SE SW 1-4s-4e, 1 mile west of Dahlgren, flowed clean oil in 65 minutes on a drill-stem test at 4,100-12 ft. in the Warsaw. This is an old well drilled deeper from 3,363 ft.

Also in Jefferson County, 9 miles northeast of Mount Vernon in NE SW NE 16-1s-4e, John F. Dunnill is testing the 1 Lawrence Eller. A drill-stem test in the McClosky at 2,846-48 ft. and 2,830-36 ft. got 4 bbl. of oil per hour. After treatment it made 10 bbl. of oil and no water hourly at 2,812-16 ft. Operator is now pump testing.

Clay County. McCollum & Kincaid and Marvin Walker have set casing at 1 Smith Heirs in SE NW SW 11-3n-7e, 5 miles northeast of Flora.

They will test the McClosky lime at 2,937-42 ft. A drill-stem test at 2,935-43 ft. gassed in 3 minutes and flowed clean oil in 31 minutes. Location is ¾ mile from other similar production.

Production tests continue in Michigan

Production tests are continuing at Bell and Gault Drilling Co. 1 Young NE NE NW 11-8s-1w, Wright Township, Hillsdale County, presently rated from 25 to 40 bbl. a day on swab after two acid treatments. A 3-ft. pay section was drilled in the Prairie du Chien dolomite at 3,458-66 ft.

An offset location and three wildcats 2 miles or more from the prospect have been staked.

Scipio-Albion sets production peak

Crude oil production from the Scipio-Albion trend field, southern Michigan, climbed to 763,943 bbl. in August for a new field peak and exceeded production for the entire state in 4 different months of 1958. Production was up 96,000 bbl. over July on the trend, the Proration Division, State Conservation Department reported.

The number of producing wells increased from 245 to 274 along the 38-mile trend. The proration division has discontinued reporting production on a "pool" basis with some of the earlier individual areas now connected.

The last available report on production for the entire state was June with 1,256,953 bbl. of which 669,403 bbl. was from fields outside the Scipio-Albion trend. A 125-bbl. per day per well limit prevails on the trend.

North Michigan leases auctioned

The northern Michigan land play is still rolling.

Local and out - of - state companies paid $115,125 bonus money for 10-year leases on 122,277 acres of state owned land at the September 14 auction conducted by the Lands Division, Department of Conservation.

Bidding on tracts ranging from 20 to 160 acres was so spirited that the advertised 1-day sale ran through 2½ days to cover the total offering of 153,000 acres, all classified as wildcat.

Fain-Porter Drilling Corp. of Oklahoma City, who opened offices in Mount Pleasant this year, set two sale highs. The company leased 17,143 acres to lead the other 46 buyers in total acreage and paid $450 bonus for a 40-acre lease in Presque Isle County to set the bonus high.

Other leading buyers at the sale included Humble Oil & Refining Co., 17,091 acres; Pure Oil Co., 12,559 acres; Kenneth Newton, New Orleans, 15,053 acres; Patrick J. O'Hornett, Oklahoma City, 7,848 acres; C. W. Sharp, 4,114 acres; Gulf Oil Corp., 7,702 acres; Texaco, 3,000 acres; Sinclair, 1,613 acres; Sun Oil Co., 2,272 acres; Natural Gasoline Corp., 2,554 acres; Pan American Oil Co., 6,876 acres; Panhandle Eastern Pipe Line Co., 3,212 acres, and Alco Oil & Gas Co., 2,024 acres.

Presque Isle County, where F. G. Lindsay, Tulsa, has just started the third wildcat in a five-well northern Michigan program, paced all other counties. A total of 39,364 acres were leased for $34,528 bonus. Fain-Porter alone took 12,348 acres in the county. A total of 32,564 acres in Cheboygan County were leased for $26,077. Smaller spreads were leased in Alcona, Alpena, Antrim, Oscoda, and Otsego counties, all in the north end of the Lower Peninsula and still north of the developed area in Michigan.

Bidding action at the sale was no surprise in view of strong bidding at the previous June 3-4 sale and strong lease and dealing going on since the first of the year. In June the state leased 83,783 acres for a bonus of $142,202, an average of $1.69 an acre compared to 94 cents an acre for the September sale.

Out of the aggressive lease play, so far Lindsay's three drilling wildcats (Leelanau, Antrim, and Presque Isle counties) represent the only drilling activity.

Fourth well tested south of Miller Creek

Oil flow on drill-stem test at the fourth well south of Miller Creek field in Crook County, Powder River basin, northeastern Wyoming.

The well is U. S. Smelting, Refining & Mining Co. 4-32 Kummerfield in C NW SW 32-51n-68w. Flow from Dakota Cretaceous at 6,111-54 ft was 15 bbl. of oil per hour. The discovery well here was 1-32 Kummerfield, a Dakota gas well in NW NE 32-51n-68w. The 2-32 Kummerfield flowed 231 bbl. per day through 13/64-in. choke from Dakota in NE SW 32-51n-68w. The 3-32 well in C SE SW 32-51n-68w flowed 192 bbl. in 8 hours through 22/64-in. choke. There are two other locations in the area. Closest Dakota production is 1½ miles north at Miller Creek.

State line. Gulf Oil Corp. completed the 8 State Line unit in NE NE 9-12n-94w, Sweetwater County. The well flowed 6,250 M.c.f.d. from perforations in the Fort Union Tertiary at 4,298-4,318 ft. Location is 2 miles northeast of nearest production.

Fields named. New fields recently named in Wyoming are Pine Ridge, Cherry Anticline, Pavillion, and Squaw Butte. Pine Ridge was opened at Woodward Jones 1 State in SW SE 36-50n-66w, Crook County, pumping 4 bbl. per day from Lakota Cretaceous at 542-545 ft. The offset well made 20 bbl. per day. Pavillion was opened at Shell Oil Co. 14-12 Pavillion unit in SW SW 12-3n-2e, Freemont County for 1,945 M.c.f.d. from 24/64-in. choke through Fort Union perforations at 3,838-58 ft. Cherry Anticline was opened at C. A. Blake 1 Government in NE NW 13-52n-92w, Big Horn County. Production was 2½ bbl. per day from Phosphoria at 1,277-87 ft. Squaw Butte was opened at Continental Oil Co. 28-1 Squaw Butte unit in NW NW 28-36n-90w, Fremont County. Flow was 3,200 M.c.f.d. on ¾-in. choke in Lance 6,338-54 ft.

Important Montana extension well finaled at Keg Coulee

In Musselshell County's Keg Coulee field Honolulu Oil Corp. completed its 25-15 Stensvad in C SW SE 25-11n-30e. Production was flowing 761 bbl. per day from 32/64-in. choke in the Tyler C sand at 4,570-4,620 ft. This is the east offset to the 25-13 Stensvad in C SW SW 25-11n-30e which flowed 650 bbl. per day. Honolulu is drilling at 4,408 ft. at the 25-11 well in NE SW 25-11n-30e, the north offset.

Ohio field stretches ½ mile

In Ohio, Ohio Fuel Gas Co. finaled a ½-mile stepout to confirm Chas. Davis et al. 1 O. F. Guenther, new pool discovery in Plain Township, Wayne County.

The test, 1 M. D. Hartman, Section 5, found natural production of 696 M.c.f.d. in the Clinton sand from 3,122 to 3,133 ft. Gage after fracture was 943 M.c.f.d. with rock pressure of 975 psi.

Also in Wayne County, King Drilling Co. reported the 3 G. R. Smith, Section 3, Canaan Township, flowed 325 barrels oil per day with 625 M.c.f.d. of gas after fracture. This completion in West Creston pool, logged the Clinton sand at 3,056-76 ft. and had a showing of oil with 59 M.c.f.d. of gas natural.

Texas multipay field gets confirmation

The second well in Amerada Petroleum Corp.'s new multipay Los Mogotes field in northern Zapata County, South Texas, not only is virtually assured of confirming the field's discovery but appears to have more pay zones than in the initial well.

Amerada's discovery well, 1 Haynes Estate, completed last May, is productive from seven zones. All are in the Queen City (Eocene - Claiborne), ranging in depth from 2,822 to 4,067 ft.

The new well (2 Haynes Estate), 2,829 ft. southwest, has tested five zones and has nearly the same number remaining to be tested. Three of the zones so far tested are deeper pays than the deepest now productive in the discovery well, although all still are in the Queen City. Deepest is perforated at 4,744-46 ft.

Production in the discovery well is dry gas with a total open-flow potential of 30 M.M.c.f.d. Each zone was selectively perforated and water-fractured, but all are productive together through a common flow string.

Gas in the zones so far tested in the second well is wet, yielding condensate in varying amounts ranging from a trace to as much as 6 bbl. daily with gas production per zone of 1,124 M.c.f.d. to 1,930 M.c.f.d.

Queen City is one of the less extensively developed but potentially productive horizons in South Texas. The new field has what is believed to be the greatest number of pay zones and amount of productive section so far found in this formation.

The new field is in a remote and sparsely explored part of the county. It is 15 miles northeast of San Ygnacio, on the Mexican border. Nearest Queen City production is more than 15 miles southeast of Echols in the same county.

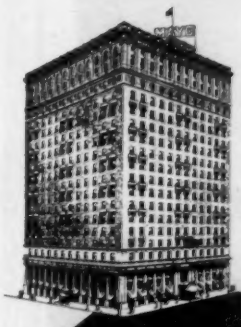
Field extended in Texas' Hardin

Productive limits of the 2-year-old West Nona Mills field, in Hardin County, Texas Gulf Coast, are being extended more than ½ mile southwest by the area's third well.

Like its two predecessors, the new well, Floyd Oil Co.'s 1 Emma Beaumont and others, is dually completed in Cook Mountain sands at 8,450 ft. and 8,500 ft.

The shallower pay, perforated at 8,455-75 ft., has an open-flow potential rating of 8 M.M.c.f.d. of gas with a gas-liquid ratio of 70,900 cu. ft. per

THE HOTEL



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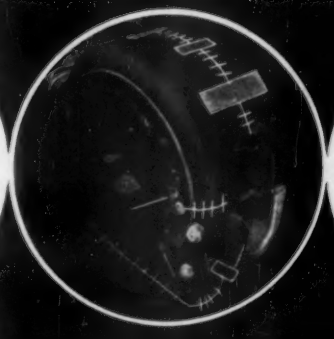

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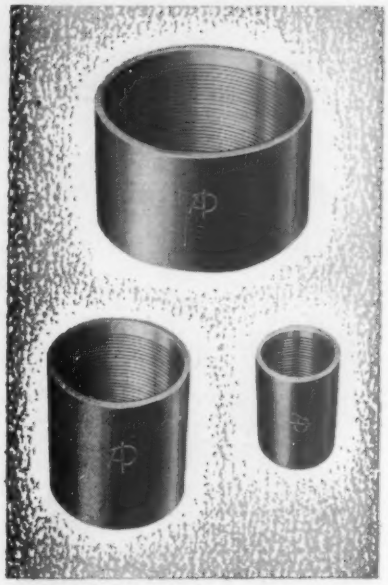

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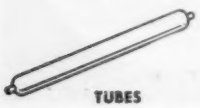

TUBES

TRANSPORTS

bbl. Liquid is 60°-gravity condensate.

The lower zone, perforated at 8,531-41 ft., is rated good for 2,900 M.c.f.d. with a ratio of 345 M.c.f. per bbl. Gravity of the condensate is 48.4°.

Texas well taps Frio in Jefferson County

New Frio production has been opened 3 miles southeast of Amelia, in Jefferson County, Texas Gulf Coast.

Discovery well, drilled by Oil & Gas Property Management, Inc., is dually completed with oil production from the upper zone at 6,284-96 ft., and gas-condensate from the lower pay at 7,722-28 ft.

Oil flow tested 135.14 bbl. per day through 10/64-in. choke with pressure of 545 psi. Gravity of the oil is 29.5°.

From the lower zone the well is rated good for 14 M.M.c.f.d. of gas. Condensate recovery is 1 bbl. to 27,820 cu. ft. of gas. Flowing pressure through 12/64-in. choke was 2,852 psi. Gravity of the condensate is 59.1°.

Discovery well, 1 H. C. Phelan, is 1 mile from nearest other Frio production in the North Cheek field.

Dual completion stretches Texas field

East Alta Mesa field, in southwestern Brooks County, South Texas, is looking up following a new dual completion extending production ¼ mile northwest and opening a new shallow pay zone.

The well, 1-A de Pena, a joint operation of Texkan Oil Co. and Caracas Petroleum Co. with oil production from Catahoula sand at 3,800 and 3,900 ft.

The deeper sand, perforated at 3,906-13 ft., is new for the area. It flowed 137 bbl. of 47°-gravity oil per day through ¼-in. choke. Flow was with gas-oil ratio of 376 cu. ft. per bbl., and pressure of 125 psi.

The other pay at 3,833-40 ft. tested 93 bbl. of 47°-gravity oil daily through ⅜-in. choke with ratio of 382 cu. ft. per bbl., and pressure of 50 psi.

The well is one of the best yet completed in the field's Catahoula sands. Most other shallow production in the area is on the pump making considerable water. Both pays in the new well are flowing, and neither has shown any water.

Deep wildcat will drill in far West Texas area

Location was set for a 13,500-ft. wildcat in northeastern Culberson County, far West Texas. Driller will be TXL Oil Corp. Wildcat will be the 1-BT Culberson Fee about 35 miles west of the town of Orla. Spot is in Section 33, Block 62, T-2, T&P Survey. It is also 7 miles southeast of Mobil Oil's recent Strawn gas discovery at 1 State-Barrett.

Pecos County. Humble Oil & Refining Co. has a Wolfcamp gas-condensate discovery at 1-E W. C. Tyrell Trustee in northern Pecos County.

The well flowed 1,100 M.c.f.d. and some condensate during drill-stem test at 12,578-96 ft. in the Wolfcamp. Operator is now drilling ahead toward the 14,600-ft. objective. Location is in Section 2, Block 5, TCRR Survey, 7 miles northeast of Fort Stockton and 8 miles east of Fort Stockton field.

Runnels County. Anderson & Graham 1 Don Woodruff 6 miles northwest of Ballinger in central Runnels County, was completed on pump for

Wilcox trend leaps southeast

SOUTH TEXAS' deep Wilcox trend of fields has jumped more than 15 miles southeastward from southern Zapata County into southwestern Starr County.

Extension of the trend is by a significant wildcat discovery by Austral Oil Co., Inc., 16 miles northwest of Rio Grande City. Nearest deep Wilcox production is in the Lopena area at the present south tip of the trend extending northward and eastward along the Zapata-Jim Hogg county line into Webb and Duval counties.

Pay zone in the new Austral discovery well is perforated at 11,704-16 ft., the greatest depth at which the South Texas deep Wilcox sands have produced so far. Depths in previously discovered fields on the trend have ranged from 7,500 to 11,000 ft. Austral's well was drilled to 13,116 ft.

Production of the well (1 Jennie V. Sanchez) as in most of the deep Wilcox fields is gas. Open-flow potential flow is 6,600 M.c.f.d. Gas is dry. Shut-in pressure is 2,485 psi. In tests through ½-in. choke the well flowed at the rate of 3,592 M.c.f.d. with pressure of 615 psi.

Nearest fields, Margo and El Puerta, each about 3 miles north and northwest, are gas-productive from the shallower Jackson and Yegua sands.

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TULSA PAPER COMPANY

52 bbl. of 46°-gravity oil per day from the Serratt sand through open hole at 2,538-42 ft. Location is in Section 167, ETRR Survey and 2 miles southeast of Northwest Ballinger field.

Reeves County. Gulf Oil Corp. will drill a deep wildcat in north-central Reeves County, 13 miles southeast of Pecos, Tex.

The wildcat will go to 18,700 ft. The name is 2 R. Cleveland et al., Section 50, Block 6, H&GN Survey.

Cook sand discovery finaled in North Texas

New Cook sand production is reported in Taylor County at Sojourner Drilling Corp. 1 B. E. Hankins "B," 4½ miles southwest of Vie and 1¾ miles southwest of Frederickson Capps lime field. The well flowed 80 bbl. of oil in 7 hours through 24/64-in. choke from perforations at 2,969-74 ft.

Location is in the Goliad County School Land Survey, 143.

Young County. Texaco Inc. 1 Oliver Abbott et al., is a new Mississippian lime oil discovery in northwestern Young County.

The well flowed 220 bbl. of oil per day on 10/64-in. choke from perforations at 4,722-56 ft. Location is on the William Tryndale Survey, A-275.

Oklahoma field well gets dual completion status

A Cleveland County field in Central Oklahoma got a new dual completion at Petroleum, Inc. 1 Juricek in NE NE 18-10n-2w, ½ mile northeast of Northeast Moore field.

The well flowed 7 bbl. of oil per hour on 10/64-in. choke from perforations at 7,222-40 ft. from the Red Fork Pennsylvanian and 9 bbl. per hour from perforations in the Bartlesville Pennsylvanian sand at 7,292-7,308 ft. on 20/64-in. choke.

The 1 Freed unit, C NE SW 28-20n-11w, will be an intended confirmation to the recent 1-A Reames unit discovery in NW SE 29. That well flowed 7,200 M.c.f.d. from Chester Mississippian at 7,378-90 ft.

Lea County, New Mexico had new Queen sand hit

A wildcat in Lea County, Southeast New Mexico, flowed 84 bbl. of oil per day on test of the Queen sand at 4,954-57 and 4,865-68 ft. It is Thomas C. Brown 1 Federal, 12 miles southwest of Monument in 4-20s-35e, 1½ miles south of Pearl Queen field. Flow was on 20/64-in. choke.

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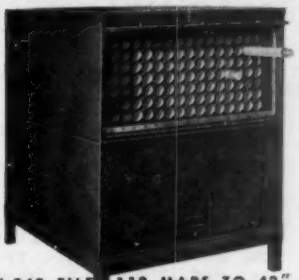

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Discovery wells

WESTERN CANADA

Alberta:

Altair Katex 7-2-36-8 Veteran, LSD 7, 2-36-8w4. Viking sand gas discovery. TD 5,555 ft.

MISSISSIPPI

Adams County:

A. M. Stall, Jr., and Charles Kelley 1 Whittington, 55-7n-1w. IP 120 BOPD, 8/64-in., 40.3°, TP 280 psi., perf. 4,296-99 ft., Wilcox. TD 4,620 ft. New-field discovery.

Franklin County:

F. H. Shortridge et al. 1 Board of Supervisors, NW NE NE 16-5n-5e. IP 206 BOPD, 8/64-in., 41°, TP 1,050 psi., perf. 10,906-12 ft., Tuscaloosa. TD 11,151 ft. Discovery well of Little Springs field.

NEBRASKA

Banner County:

Edward M. Davis 1 Peterson, C SE NW 6-18n-56w. IPP 125 BOPD, "D" sand 6,236-39 ft. TD 6,435 ft. "D" sand discovery, new field.

TEXAS GULF COAST

Bee County:

Hugo Allen and M. J. Mitchell 1 William H. Welkener, Francis Chessman Sur., 5 miles northwest of Mineral. AOF 4,100 M.c.f.d., dry gas, 953 psi., perf. 2,964-68 ft., Pettus sand. TD 3,510 ft. New reservoir and extension discovery to Plummer area.

Hugo Allen and M. J. Mitchell 1 A. J. Smith, J. R. Johnson Sur., 6 miles northwest of Mineral. AOF 7,400 M.c.f.d., dry gas, 725 psi., perf. 1,807-11 ft. TD 2,020 ft. New-pay discovery in Plummer area.

DeWitt County:

Kirkwood Drilling Co., and Musselman & Grace 1 Pridgen Oil unit, Charles Lockhart Sur., A-26, 4 miles west of Thomaston. AOF 4,800 M.c.f.d., GLR 133.5 M.c.f. per bbl., 56.7°, shut-in TP 2,520 psi., perf. 7,812-26 ft., Wilcox. TD 8,435 ft. New pay and extension in Thomaston area.

Goliad County:

Miller & Fox Drilling Corp. 1 W. D. Lude, Jose M. Mancha Sur., A-203, 6 miles southwest of Weesatche. AOF 3,400 M.c.f.d., GLR 15.8 M.c.f. per bbl., 59.2°, shut-in TP 2,440 psi., perf. 7,389-91 ft., Reklaw. TD 7,833 ft. New-field discovery in Cabesa Creek area. (OWWO—formerly plugged and abandoned at 7,908 ft.)

Kleberg County:

Humble Oil & Refining Co. 27 King Ranch Alazan, Las Comitas Grant, 13 miles southwest of Chapman Ranch. IP 151 BOPD (net, 56% water), ¼-in., 44.7°, GOR 848 cu. ft. per bbl., 590 psi., perf. 5,745-51 ft., Frio. TD 9,000 ft. New pay in North Alazan field.

Live Oak County:

McGarr & Trusler et al. 2-B Maggie McNeill, Section 27, BS&F Sur., 8 miles south of Mikeska. IP 105 BOPD, 8/64-in., 32.8°, GOR 850 cu. ft. per bbl., TP 900 psi., perf. 4,375-82 ft., Massive Hockley. TD 4,445 ft. New pay discovery and extension in East C. A. Winn area.

Madison County:

Pure Oil Co. (Christi, Mitchell & Mitchell) 1 Lummie Morgan, Antonio Del Rio Sur., A-26, 4½ miles southwest of Madisonville and 1 mile west of depleted Iron Creek. IP 247.97 BOPD, ¼-in., 31.3°, GOR 2,650 cu. ft. per bbl., TP 950 psi., perf. 9,322-26 ft., Woodbine. TD 9,652 ft. New-field discovery—Northeast Madisonville.

Nueces County:

Arnold O. Morgan 1 Chapman Heirs-J. O. Chapman, Jr., et al., Sect. 113, Laureles Farm Tracts. IP 152 BOPD, P-32 choke, 41.6°, GOR 855 cu. ft. per bbl., TP 1,090 psi., perf. 6,092-93 ft., Frio. TD 8,560 ft. New-field discovery.

Orange County:

Texaco Inc., 26-B W. H. Stark, Mary A. E. Hall Sur., A-403, 2½ miles northeast of Port Neches. AOF 7,200 M.c.f.d., GLR 249 M.c.f. per bbl., 54.3°, shut-in TP 659 psi., perf. 7,699-7,794 ft. over-all, Hackberry. TD 8,050 ft. New pay in Port Neches field.

Victoria County:

Edwards, Ford & Hamilton 1-Sec. 2 R. H. Welder Heirs, Sec. 2, AS&MG Sur., A-427, 6 miles northeast of Nursery.

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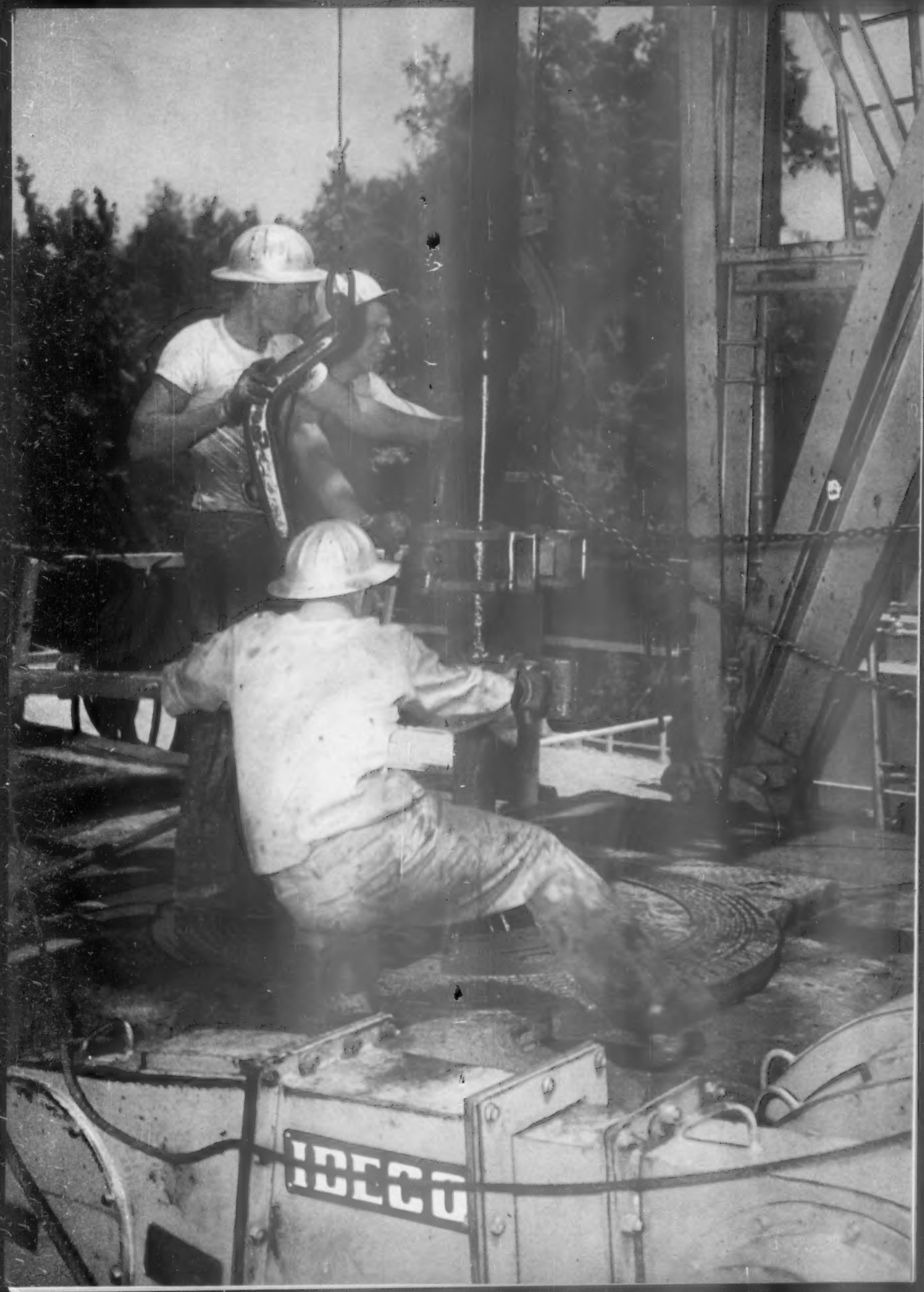
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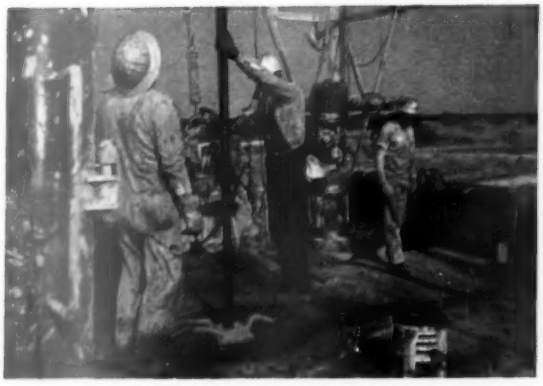

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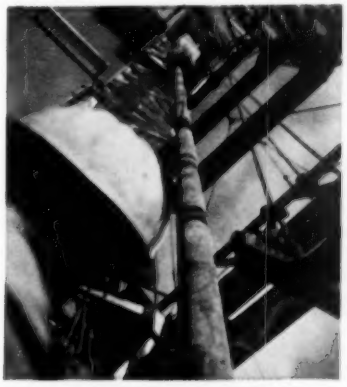

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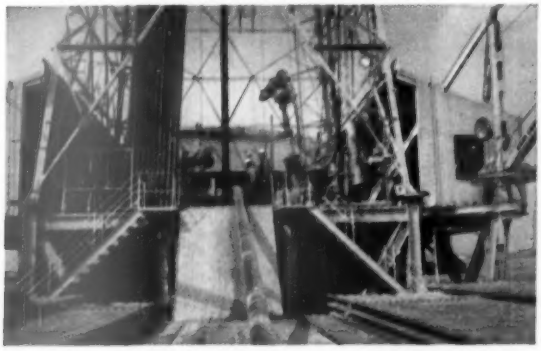

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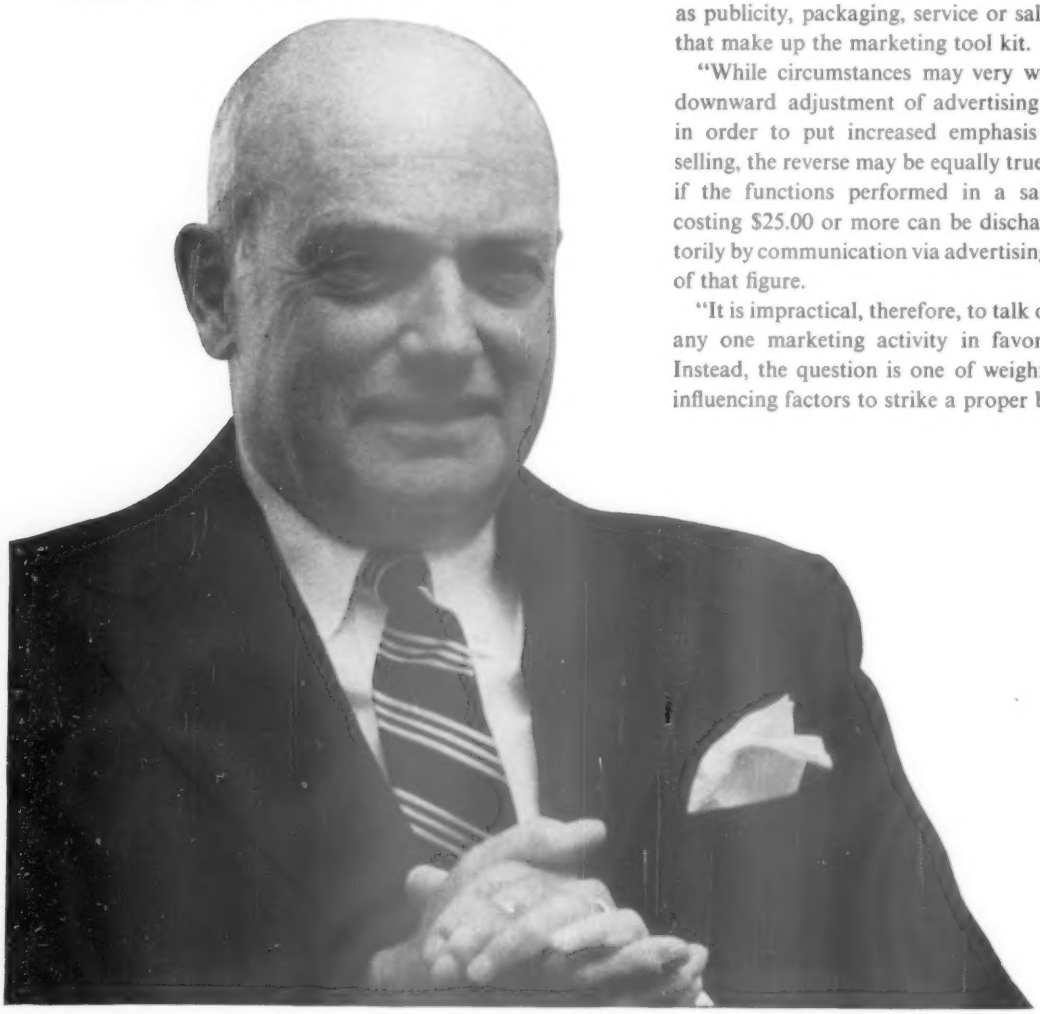

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AOF 17,200 M.c.f.d., GLR 43,480 M.c.f. per bbl., 55.4°, shut-in TP 2,953 psi., perf. 8,485-8,526.5 ft., Wilcox. TD 8,700 ft. New pay in Southwest Helen Gohlke field.

Shell Oil Co. 5-B G. A. Musselman, Section 5, IRR Sur., A-206, 24 miles north of Victoria. AOF 95 M.M.c.f.d., dry gas, shut-in pressure 1,264 psi., perf. 2,974-80 ft., Frio. TD 3,114 ft. New pay in Helen Gohlke field.

SOUTHWEST TEXAS

Duval County:

Humble Oil & Refining Co. 89-A V. Kohler, Section 163, J. Poitevent Sur., A-383, 20 miles southwest of Freer. AOF 3,900 M.c.f.d., perf. 5,800-5 ft., Queen City. TD 6,503 ft. New-field discovery in Kohler area.

Gulf Coast Minerals Management Corp. et al. 2 C. M. Robinson, Section 408, Paul Henry Sur., A-1324, 7 miles northwest of San Diego. AOF 4,500 M.c.f.d., dry gas, shut-in pressure 1,205 psi., perf. 3,247½-50½ ft., Frio. TD 4,802 ft. New pay and extension in Robinson area.

Afroma Oil & Gas Co. et al. 1 State-D. Ruiz, Section 128, G. Ruiz Sur., A-1922, 7 miles south of Freer. AOF 4,600 M.c.f.d., dry gas, shut-in pressure 700 psi., perf. 2,673-46 ft., Government wells sand. TD 3,508 ft. New-field discovery.

Jim Wells County:

Associated Oil & Gas Co., Gulf States Development Corp., Investors Syndicate of the Southwest 1-A W. M. Fitzsimmons et al., Sec. 74, Charles D. Fitzsimmons Sur., A-154, 8 miles west of Ben Bolt. AOF 370 M.c.f.d., GLR 200 M.c.f. per bbl., 65°, shut-in TP 2,384 psi., perf. 5,176-90 ft., Frio. TD 6,297 ft. New pay in Asoq field.

L. R. Eddy and Marion Messer 1 Jose Barrera, Share 8, La Vaca Grant, A-166, 3 miles southwest of Alice. AOF 11 M.M.c.f.d., dry gas, shut-in TP 1,386 psi., perf. 3,431-33 ft., Frio. TD 5,111 ft. New-field discovery.

McMullen County:

Humble Oil & Refining Co. 9 Louis M. Gubbels, Sec. 26, G. H. Smith Sur., A-430, 10 miles northeast of Tilden. IPP 25 BOPD (net), 60% water, 34.6°, perf. 5,680-90 ft., Wilcox. TD 6,400 ft. New pay in San Miquel Creek field.

Starr County:

Breuer & Curran Oil Co. 1 Mary S. Thomas, Porcion 103, 15 miles northwest of Rio Grande City. IP 200 M.c.f.d., TP 500 psi., perf. 3,580-97 ft., Cook Mountain. TD 6,010 ft. New-field discovery.

Uvalde County:

J. W. Gorman 3 Woodley Ranch, Maria S. G. Y. Huizar Sur., A-235, 10 miles south of Sabinal. AOF 29 M.M.c.f.d., dry gas, shut-in TP 315 psi., open hole 708-20 ft., Navarro. TD 720 ft. New-field discovery.

Zapata County:

Crescent Oil & Gas Corp. 2 Juan G. Bemavides, Share 13, Porcion 22. AOF 4,500 M.c.f.d., GLR 146 M.c.f. per bbl., 44.8°, shut-in TP 6,992 psi., perf. 10,082-90 ft. and 10,124-44 ft., Wilcox. TD 11,921 ft. New pay in Northeast Lopeno field.

TEXAS PANHANDLE

Carson County:

Amarillo Oil Co. 3R Deahl "B," Sec. 5, Blk. 5, B&B Sur. 15 miles northwest of Panhandle in Panhandle field, Tubb sand discovery. IPCAOF 3,200 M.c.f.d., SIP 5,389 psi. Tubb 1,437-1,503 ft. TD 2,065 ft.

Hansford County:

Drilling & Exploration Inc. et al. 1-8 Knutson, Sec. 8, Blk. 45, H&TC Sur. IPCAOF 10,300 M.c.f.d., SIP 1,470 psi. Lansing 4,660-70 ft. TD 7,260 ft. New gas discovery in Brillhart area.

Moore County:

Colorado Interstate Gas Co. 1-R Masterson, Panhandle field, West Red Cave area, Sec. 76, Blk. 9-18, D&P Sur. IPCAOF M.c.f.d., SIP 361 psi. Red Cave 2,095-2,175 ft. TD 2,260 ft. Gas discovery.

Ochiltree County:

James F. Smith et al. 1 Pearl Witt, OWWO, 47-11-Ahrenbeck Sur., 3 miles west of Perryton, 3,100 M.c.f.d., 6 BCPM, Morrow, 7,960-70 ft. IPCAOF 2,200 M.c.f.d., 3 BCPM, Mississippian 8,080-8,144 ft. TD 8,150 ft. Dual gas discovery.

Shamrock Oil & Gas Corp. 1 Chester H. Williams, 83-13-T&NO Sur. 19 miles southwest of Perryton. IPCAOF 4 M.M.c.f.d., upper Morrow 8,536-69 ft. SIP 2,214 psi. TD 9,640 ft.

WEST CENTRAL TEXAS

Brown County:

Coastal States Gas Production Co. 1 W. F. Kilgore, 5 miles southeast of Cross Cut in Robert Mitchell Sur. 141 A-623. IPF 64 BOPD. ¾-in. choke, 41°, GOR 430:1, CP 580 psi., TP 35 psi. lime 2,635-61 ft. TD 2,733 ft. New oil discovery.

Coleman County:

Fletcher 1-B Bennie Smith, 1 mile north of Goldsboro in Wm. Miller Sur. 469. IPP 38 BOPD, 41°, GOR 1120:1. Gray sand 3,959-61 ft. TD 4,009 ft. New oil discovery.

Howard & Boles 1-A O. C. Bertrand, 3 miles south of Glen Cove in Sec. 42, BBB&C Sur. IPCAOF 4,850 M.c.f.d., plus 40 BWPD, Jennings sand 3,323-40 ft. TD 3,440 ft. New gas discovery.

Haskell County:

Fletcher Oil & Gas Drilling Corp. 1 Jim D. Norman, 2½ miles southwest of Rule in Sec. 76, Blk. 1, H&TC Sur. IPF 78 BOPD, 30/64-in. choke. 41°, GOR 360:1, packer, TP 80 psi. lower Strawn sand 5,511-22 ft. TD 5,735 ft. New oil discovery.

Nemours Corp. 1 D. H. Brown, OWWO, 3 miles northwest of Haskell in P. H. Anderson Sur. IPP 101 BOPD, plus 5% water, 39.4°, Strawn sand 4,772-82 ft. TD 5,478 ft. New oil discovery.

Jones County:

Fletcher 1 Billy W. Ashley, 4 miles northwest of Noodle in Subd. 49, M. W. Dikes Sur. 218. IPF 92 BOPD, 18/64-in. choke, 39.8°, GOR 515:1, CP 300 psi., TP 120 psi. 3,899-3,902 ft. and 3,912-14 ft. TD 4,200 ft. New oil discovery.

Stephens County:

Wilson Exploration Co. 1 F. A. Dean, 4 miles southwest of Frankell in Sec. 87, Blk. 6, T&P Sur. IPCAOF 2,600 M.c.f.d., 3,762-42 ft. conglomerate. TD 4,400 ft. New gas discovery.

Taylor County:

Dixon Drilling Co. 1 J. M. Smallwood, 2 miles north of Lawn in W. A. Smith Sur. 402. IPP 71 BOPD, 40.5°, GOR 215:1, McMillan sand 2,737-39 ft. TD 2,740 ft. New oil discovery.

S. C. Herring Drilling Co. 1-A C. W. Thornton, 2 miles northeast of View in Wm. B. Hardin Sur. 130. IPF 528 BOPD, open 2-in. tubing, 43.6°, GOR 820:1, packer, TP 240 psi. Morris sand 4,162-81 ft. TD 4,400 ft. New oil discovery.

WEST TEXAS

Andrews County:

Eastland Drilling Co. 1 Pan American-University, 17 miles southwest of Andrews in Sec. 5, Blk. 11, Univ. Lands Sur. IPP 38 BOPD, plus 50% water, 33.3°, GOR 720:1. San Andres 4,384-4,414 ft. TD 4,519 ft. New oil discovery.

Dawson County:

Santiago Oil & Gas Co. 1 M. V. Bowlin, 2 miles northwest of Ackerly in Sec. 3, Blk. 34, T-3-N, T&P Sur. IPF 1,860 BOPD 14/64-in. choke, 42.5°, GOR 800:1, TP 800 psi., packer, Penn reef 9,481-9,512 ft. TD 9,550 ft. New oil discovery.

Nolan County:

Sherwood B. Owens 1 C. W. Tipton, 1¼ miles southeast of White Flat Multipay field in Sec. 43, Blk. 19, T&P Sur. IPF 262 BOPD, 24/64-in. choke, TP 165 psi., 43°, GOR 850:1. Strawn 5,120 to 5,146 ft. TD 5,186 ft. New oil discovery.

Pecos County:

George T. Abell 1-B State Corrigan, 2 miles south of Imperial in Sec. 14, Blk. 3, H&TC Sur. IPF 81 BOPD, 14/64-in. choke, 36°, TP 100 psi., CP 200 psi., Grayburg open hole 2,238-60 ft. TD 2,260 ft. New oil discovery.

Runnels County:

American Liberty Oil Co. et al. 1 J. E. Virden, 12 miles west of Winters in H&TB Sur., 827, A-299. IPP 107 BOPD, plus 25% water, 44°, GOR 470:1, Canyon sand 4,104-14 ft. TD 5,398 ft.

Callihan Interest Inc, et al. 1 R. P. Penny, 3 miles northeast of Kendrick in Sec. 492, M. Fitzpatrick Survey. IPF 113 BOPD, 20/64-in. choke plus 15% water, 41°, GOR 900:1, TP 375 psi., CP 560 psi. Gardner sand 4,372-75 ft. TD 4,655 ft. New oil discovery.

Ward County:

Continental Oil Co. 1-87 Black, 87-34-H&TC Sur. IPF 241 BOPD, plus 48% water, 20/64-in. choke, 40°, GOR 1,867:1, TP 275 psi., packer. Bell Canyon 4,978 to 5,106 ft. TD 6,190 ft. PBTD 5,157 ft. New oil discovery.

Winkler County:

Skelly Oil Co. 167 S. M. Halley, 9 miles southeast of Kermit in Sec. 24, Blk. B-11, PSL Sur. IPF 336 BOPD, ¼-in. choke, 50.6°, GOR 552:1, TP 675 psi. packer, Waddell 11,612-11,760 ft. TD 12,107 ft. Dual oil discovery. IPF 1,027 BOPD, 1-in. choke, 41°, GOR 1,698:1, TP 260, packer. Ellenburger open hole 12,097-12,107 ft.

Yoakum County:

Texaco Inc. 17-B Mrs. Annie Miller, 2 miles northwest of Denver City in Sec. 862, Blk. D, John H. Gibson Sur. IPP 224 BOPD, 39.1°, GOR 177:1, Wichita Albany 8,381 to 8,494 ft. IPP 182 BOPD, plus 15% water, 38.4°, GOR 227:1, Wolfcamp 8,680-94 ft. TD 11,038 ft. PBTD 8,810 ft. New dual oil discovery.

WYOMING

Carbon County, South Baggs unit:

Phillips Petroleum Co. 8 Unit, SW SW 10-12n-92w. IPF 1,760 M.c.f.d., ½-in. choke, TP 800 psi. Lewis 4,399-4,942 ft. TD 16,248 ft. PBTD 8,300 ft.

Sublette County, Mickelson Creek:

Raymond I Smith 2 Unit, SW NW 29-32n-114w. IPF 360 BOPD, 22/64-in. choke, TP 750 psi., CP 1,150 psi., GOR 802:1, Mesaverde 3,536-49 and window at 3,546 ft. TD 4,285 ft. Mesaverde discovery, new field.

▶▶▶ Personals

Herbert F. Beardmore, manager of Gulf Oil Corp.'s Houston production district, has been elected vice president in charge of all Gulf domestic production operations. He will headquarter in Houston. Beardmore succeeds **Robert L. Boggs,** who is retiring after 33 years of service with Gulf. Beardmore was vice president of production for Warren Petroleum Corp. when Warren became a Gulf subsidiary in 1956. He had worked for Amerada Petroleum Corp. and the old Barnsdall Oil Co. before joining Warren in 1947.

BEARDMORE

Warren Vandiver, senior process engineer at DX Sunray Oil Co.'s Tulsa refinery, has joined the process-engineering staff of Suntide Refining Co. in Corpus Christi, Tex. **Jack Wynn,** recent graduate of Duke University, has also joined Suntide's process-engineering staff.

Mal Weiss, hydrotreating section head in Esso Research & Engineering Co.'s products research division, Florham Park, N. J., has been named head of the new fuel-cell section in products research.

In a realignment of operating divisions in Illinois, Indiana, Michigan, and Ohio, Buckeye Pipe Line Co. has set up new divisions in Cleveland, Toledo, and Lima, Ohio. **L. A. Miller** has been named superintendent in Lima, **P. T. Dunkle,** superintendent in Cleveland, and **E. R. Shearer,** superintendent in Toledo.

J. L. Latimer, Dallas, senior vice president of Mobil Oil Co., has been named an honorary member of the executive committee of Texas Mid-Continent Oil and Gas Association. The honor is the first of its kind ever awarded by the association. At TMOGA's recent annual meeting, **Estill S. Heyser,** Dallas, independent producer, was reelected president. Five new district vice presidents were named. They include **Norman E. Loomis,** Longview, for East Texas; **Frank P. Zoch,** Turnbull & Zoch Drilling Co., Corpus Christi, for lower Gulf Coast; **I. P. Underwood,** Amarillo, Panhandle; **Harold Decker,** Highland Oil Co., Houston, middle Gulf Coast; and **J. C. Hunter,** Abilene, West Central Texas.

George H. Heyburn, sales manager in Denver for Standard Oil Co. (Ind.), has been promoted to Kansas City district sales manager. **John R. Owens** will succeed Heyburn in Denver.

A. C. Best, economic evaluation department supervisor in Dow Chemical Co.'s Texas division, has been transferred to the Dowell division in Tulsa, where he will work with economic evaluation and financial analysis.

R. B. Thompson has been named manager of Mobil Chemical Co.'s technical department in Beaumont, Tex. **R. E. Turkleson** has been named manager of production, Beaumont, and **W. E. McKellar, Jr.,** has been named manager of employe relations.

R. A. Longmire, assistant head of the process engineering department at Humble Oil & Refining Co.'s Baton Rouge refinery, has been transferred to New York as head of the supply section in Esso Export Corp.'s lubes, wax, and grease department.

John N. Klemer, Bismarck, N. D., independent geologist, has joined Harris & Brown, Bismarck consulting firm, as a general partner. The firm name will be changed to Harris, Brown, & Klemer.

Dudley Tower, executive vice president of Union Oil Co. of California, has been named president of the company. He succeeds **Reese H. Taylor,** Union's chairman and chief executive officer, as president. Taylor has held the office of both chairman and president since the retirement last spring of **A. C. Rubel** as president. Tower is a veteran Union employe, having joined the company in 1935 as a pipeline roustabout at Long Beach, Calif., in 1935. He has worked in the drilling and production divisions in both California and the Gulf Coast. In 1946 he was named as manager of the company's Gulf Coast division in Houston. He was elevated to vice president in 1953 and returned to Union's Los Angeles office in 1955 to become vice president in charge of drilling, production, and engineering operations. Tower was named executive vice president last April.

TOWER

Dudley Tower, president of Union Oil Co. (see above), and **I. G. (Ike) Morgan,** vice president of Texaco Inc., have been elected to the board and executive committee of Western Oil and Gas Association. Tower was named to the board shortly after Union rejoined WOGA. Morgan replaces **James T. Wood, Jr.,** Texaco's senior vice president who retired recently.

Roland A. Beck, supervisor of experimental operations at the Montebello, Calif., research laboratory of Texaco Inc., has been appointed director of the laboratory. He succeeds the late Du Bois Eastman. Beck joined Texaco in 1941 as chemist in fuels research at the Beacon, N. Y., research center. He was project leader in fuels research there before moving to Montebello in 1949.

D. R. Moore has been promoted to supervising engineer in the technical division of Humble Oil & Refining Co.'s Baytown, Tex., refinery. He will head the section responsible for long-range planning and development of major projects. **R. J. Davis** and **R. C. Wahrmund** have been named staff engineers in the Baytown technical division. Davis will handle controls and systems engineering in the operations-services section. Wahrmund will work with process design of refining and chemical units in the process-engineering section.

Charles W. McCloud, technical foreman in the coking area of Tidewater Oil Co.'s Delaware City, Del., refinery, has been promoted to supervisor of the coking area. He succeeds **George M. Rose,** who has been given a special assignment as assistant in petrochemical development. **Charles A. Campbell,** special representative to Mitsubishi Oil Co., Japan, has been named technical foreman in the coking area and **Joseph H. Schramm,** staff engineer in the cracking area, has been promoted to technical foreman. In other changes at Delaware City, **Bernard E. Woods,** night superintendent, has been named employe counselor, a new position. He will be succeeded by **Lyle C. Pratt,** shift foreman, crude, coking, and cracking. **George A. Koval,** area shift leader, crude unit, will succeed Pratt. **Louis N. Pederson,** engineer, technology, has been named staff engineer in the utilities and sulfur-recovery area. **William H. Hatfield,** acting shift leader in the cracking area, has been promoted to shift leader. **Stanley A. Brozek,** operator, crude unit, has been named acting shift leader, crude area.

Phil McKenna, geologist for Pure Oil Co., has been transferred to Worland, Wyo., from Olney, Ill.

Jack L. Gogek has been named a senior applications research chemist in Texas Butadiene & Chemical Corp.'s Miami laboratories.

Charles E. Bathel, Jr., administrative assistant to the general manager of Continental Oil Co.'s petrochemical department in Houston, has been promoted to assistant director of the marketing-research division, Houston.

Robert W. Sneed, vice president of Well Completions, Inc., will head Airdrill International, Inc., Denver, newly formed subsidiary of Well Completions.

James M. Guenther, petroleum engineer with Texaco Inc., has been transferred to Cortez, Colo., from Odessa, Tex.

Thomas R. Pruitt, assistant superintendent of gas and gas products in Sinclair Oil & Gas Co.'s North Texas division, Fort Worth, has been transferred to Tulsa as an assistant superintendent of gas contract and measurement in the gas and gas products division.

G. L. Conn, Jr., has been elected a vice president of Richmond Exploration Co., subsidiary of Standard Oil Co. of California. He will continue as manager of Richmond's manufacturing operations in Maracaibo, Venezuela. Conn joined California Standard in 1938. He was transferred to Richmond in 1955 as superintendent of manufacturing.

Millard E. Stone, vice president in charge of industrial relations for Sinclair Oil Corp., will direct a new management - development and personnel - coordination program for Sinclair and its operating subsidiaries. Stone's title will be vice president in charge of employe and community relations. His department will be responsible for personnel administration, industrial relations, management development, and community relations. The department will perform service and coordination functions in these fields, will set policy for the Sinclair companies, and will assist all subsidiaries in carrying out company policy.

Robert E. Boyle, engineer with Service Pipe Line Co., has been promoted to assistant chief gager. He succeeds **Bert M. Cromack,** who has retired.

M. L. DeCraene, superintendent of pipelines for Natural Gas Pipeline Co. of America, has been named assistant general superintendent of pipelines, a new position. **T. H. Beals,** superintendent of development engineering, has been named chief planning engineer, a new position. **R. W. Lindgren,** administrative assistant to the president, will succeed Beals, and **H. E. Boomer,** superintendent of pipelines for Peoples Gulf Coast Natural Gas Pipeline Co., an affiliate, will succeed Lindgren.

Arthur H. Oesterheld has been appointed manager of systems and procedures for Texas Gas Transmission Corp. He will be responsible for analysis and evaluation of the company's systems and procedures and for development of plans for improvement and economies.

Richard Kucia, formerly with Olin Mathieson Chemical Corp., has joined the research department of Monsanto Chemical Co.'s Lion Oil Co. division in El Dorado, Ark. **Robert T. Bell** and **James Kanyok** have joined the engineering department of Monsanto's plastics division plant in Texas City. **Sidney Rankin** has joined the plastics division research department in Springfield, Mass.

D. E. Killam, Jr., Lafayette, La., district land man for Texas Gas Exploration Corp., has been appointed manager of the land department. He will supervise drilling agreements and acquisition and maintenance of company leases. Killam will headquarter in Houston.

Dr. Paul Davidson, formerly assistant professor of economics at Rutgers University, New Brunswick, N. J., has been appointed assistant director of Continental Oil Co.'s economics division in Houston. He will be in charge of the general economics section.

Eric B. Hjerpe, director of the operations planning and scheduling division of Gulf Oil Corp.'s Port Arthur, Tex., refinery, has been appointed director of the chemical-processing division. He succeeds **William S. Bonnell,** who recently was transferred to Gulf's Philadelphia refinery as manager of operations. Hjerpe will be responsible for all petrochemical operations of the Port Arthur refinery.

▶▶▶ Personals

Alex G. Bailey, executive vice president of Bailey-Selburn Oil & Gas, Ltd., and president of Alberta Gas Trunk Line, Ltd., has been elected provisional president of Independent Canadian Petroleum Producers, new group organized to work for a national oil policy in Canada. Other provisional officers are **Charles Hay,** president of Royalite Oil Co., Ltd., vice president; and **John F. Hardy,** vice president and general manager of Central-Del Rio Oils, Ltd., secretary-treasurer. Directors are **Robert A. Brown, Jr.,** president of Home Oil Co., Ltd.; **Carl O. Nickle,** president of Conick Petroleums, Ltd.; **William S. McGregor,** president of Consolidated Mic Mac Oils, Ltd.; **Charles S. Lee,** president of Western Decalta Petroleum, Ltd.; **Alex Clark,** president of Calgary & Edmonton Corp., Ltd.; **Jack B. Webb,** vice president and general manager of Alminex, Ltd.; **Ed A. Galvin,** president of Medallion Petroleums, Ltd.; **Jack P. Gallagher,** president of Dome Petroleum, Ltd.

BAILEY

Dr. Charles A. Thomas, chairman of Monsanto Chemical Co., will receive an honorary doctor of laws degree from Lehigh University, Bethlehem, Pa., during Founder's Day ceremonies at the school October 9.

E. M. Charlet, formerly on the technical staff at Humble Oil & Refining Co.'s Esso Research Laboratories, Baton Rouge, has been given a rotational assignment with Esso Research, Ltd., in Abingdon, England. **W. C. Behrmann** and **R. A. Tynes** have joined the Baton Rouge technical staff.

A. L. Hazle has been named president of Bison Petroleum & Minerals, Ltd., Calgary. Merger of Bison, Paramount Petroleum & Mineral Corp., Ltd., and Viscount Oil & Gas, Ltd., has formed the reorganized company. Hazle was formerly president of Paramount. **L. A. Pearce,** president of Viscount and vice president of Paramount, has been named vice president of the new company. **J. J. Sribney,** chief geologist of Paramount and vice president of Viscount, has been named vice president in charge of exploration. **J. P. Criton,** Paramount chief accountant, will be secretary-treasurer.

AAODC SLATE includes, front row, left to right: C. B. Webster, vice president; E. Dale Mount, secretary-treasurer; Earle C. Hellums, national vice president; John J. Moran, president; Warren L. Baker, executive vice president; Joseph M. Shelton, general counsel. Back row: C. H. Todd, George B. Kitchel, Paul F. Rutledge, M. L. Vance, John S. Hagestad, James H. Phillips, Jr., and R. C. Tucker, all regional vice presidents.

Wichita Falls Contractor Elected AAODC President

John J. Moran, Moran Brothers, Inc., Wichita Falls, has succeeded W. L. McClusky, M. J. Delaney Co., Dallas, as president of American Association of Oilwell Drilling Contractors. Moran was elected at AAODC's meeting last week in New Orleans.

AAODC honors at the meeting went to George F. McQueen, McQueen & Stout Drilling Co., Fort Worth; and George P. Livermore, Livermore Drilling Co., Lubbock, Tex., who received meritorious service awards recognizing contributions to the industry and the association.

Also, W. C. Fatjo, W. C. Fatjo Drilling Co., Lafayette, La., and J. H. Phillips, Jr., King-Phillips, Inc., Fort Worth, received plaques for outstanding association work. Fatjo served as 1960 chairman of the Lafayette chapter of AAODC. Phillips was 1960 chairman, Fort Worth-Dallas chapter.

Other new AAODC officers include: Earle C. Hellums, Gracey-Hellums Corp., Houston, national vice president; E. Dale Mount, Dale Mount Drilling, Inc., Dallas, secretary-treasurer, and Joseph M. Shelton, Lyne, Blanchette, Smith & Shelton, Dallas, general counsel.

Regional vice presidents and their areas are: F. M. Stevenson, Signal Drilling & Exploration, Inc., Denver, vice president for cable tools; R. C. Tucker, Great Western Drilling Co., Midland, Tex., vice president for New Mexico and West Texas; John S. Hagestad, John S. Hagestad Drilling Co., Bakersfield, Calif., California.

John R. Burns, Burns Drilling Co., Evansville, Ind., Illinois, Indiana, Michigan, and Kentucky; C. B. Webster, C. B. Webster Drilling Co., Houston, Gulf Coast; C. H. Todd, R. W. Rine Drilling Co., Wichita, Central Mid-Continent; Paul F. Rutledge, Rutledge Drilling Co., Inc., Santa Fe, Rocky Mountains.

J. J. Harrigan, Standard Drilling Co., Inc., Oklahoma City, well servicing; J. K. Maxwell, Carter-Jones Drilling Co., Kilgore, Tex., Cretaceous and Tertiary basins; James H. Phillips, Jr., King-Phillips, Inc., Fort Worth, North and West Central Texas; and George B. Kitchell, Kerr-McGee Oil Industries, Inc., Houston, offshore. Warren L. Baker, Dallas, was reelected executive vice president.

John V. Brock, formerly geologist with Sinclair Oil & Gas Co., has joined Superior Oil Co. in Midland, Tex.

Craig A. Lyon, geologist with Standard Oil Co. of California, has been transferred to Bakersfield, Calif., from Salt Lake City.

Howard K. Nason, vice president of Monsanto Chemical Co. and general manager of the research and engineering division, has been named president of Monsanto Research Corp., St. Louis, a newly organized subsidiary. The company will conduct special research programs for the government. **Erwin G. Somogyi** has been elected a vice president of Monsanto, succeeding Nason.

Don E. Satterthwaite, president of Se Ro Bee Drilling Co., Inc., has resigned to become an independent operator with headquarters in Wichita.

J. E. Finley, regional exploration manager in Denver for Buck Creek Oil Co., a subsidiary of Continental Oil Co., has been elected a director. He succeeds **C. B. Smith, Jr.,** on the Buck Creek board.

Bill Shoger, petroleum regulatory engineer for United States Geological Survey in Farmington, N. M., has been transferred to Roswell, N. M. **John Ward,** independent operator, has joined USGS in Farmington.

William C. McCammon, assistant to the president of Standard Oil Co. of California, has been named vice president, supply and transportation, for Standard Oil Co. of California, Western Operations, Inc. McCammon has been with California Standard companies since 1932. He had been assistant to the president since 1954.

David A. Donaldson has joined Aztec Oil & Gas Co. in Farmington, N. M., as a geologist.

Daniel H. Meyer, formerly with Standard Oil Co. of California, has joined Great Yellowstone Corp., Salt Lake City, as executive vice president, general manager, and a director.

Gerald Fisher, pollution-control coordinator for Mobil Oil Co., has retired after 37 years with the company. Fisher is chairman of the West Coast section, Air Pollution Control Association, and has been air pollution control coordinator for the Western Oil and Gas Association during the past year.

L. C. Price, division foreman in the chemical products division, cracking department, of Humble Oil & Refining Co.'s Baton Rouge refinery, and **A. D. Martin,** division foreman of isopropanol, benzene, and resin, alcohol department, have been given loan assignments with Standard-Vacuum Oil Co. in Australia. **John J. Burns,** shift foreman, cracking department, will succeed Price in Baton Rouge. **R. J. Martinez,** night superintendent, will succeed Martin. **Walter T. Miller,** temporary shift foreman in chemical products division cracking, will succeed Burns.

E. F. Carlston, senior research chemist for California Research Corp., has been promoted to research associate in chemicals-exploratory research at the Richmond, Calif., laboratory. **Dr. L. L. Ferstandig,** group supervisor, also has been named research associate in chemicals-exploratory research, Richmond. **Dr. C. J. Egan,** senior research chemist, has been named research associate in physical chemistry at Richmond. At the La Habra, Calif., laboratory, **Dr. L. H. Berryman** has been appointed senior research physicist in the geophysics-development section.

Paul W. Stade, Jr., reservoir engineering supervisor for Atlantic Refining Co. in Dallas, has been transferred to Philadelphia as a planning coordinator in Atlantic's new coordinated planning and economics department. **Charles A. Hutchinson, Jr.,** supervisor of the reservoir mechanics group in research and development, Dallas, has replaced Stade. **Al Dyes,** supervisor of research and development's reservoir-engineering group, has succeeded Hutchinson. **Phil Braun,** group leader in reservoir mechanics, has succeeded Dyes, and **Tom Moore,** reservoir-mechanics group, has succeeded Braun as group leader.

McGEE

H. W. McGee, district exploration superintendent in Pan American Petroleum Corp.'s Tyler, Tex., district, has been appointed Rocky Mountain division consulting geologist. **J. L. Severson** has been named Rocky Mountain division consulting geologist, a new position. McGee has been with Pan Am since 1945. He was district geologist in Shreveport, La., before being transferred to the Tyler district.

John Chase, staff geologist for Sinclair Oil & Gas Co., has been transferred to Casper, Wyo., from Albuquerque.

Luke S. Gournay, senior research physicist for Socony Mobil Oil Co.'s field research laboratory in Dallas, has been awarded the 1960 Socony Mobil incentive fellowship. He will work toward a doctor's degree in physics at the University of Colorado.

▶▶▶ Personals

Elmer Swope, plant foreman in Ashland, Ky., for Ohio Fuel Gas Co., has retired after 40 years with the company.

Lawrence Householder, southern Ohio superintendent for Wiser Oil Co., Sistersville, W. Va., has retired after 42 years with the company.

J. W. Pitts, supervisor of the quality-control section at Jefferson Chemical Co.'s Port Neches, Tex., plant, has been promoted to supervisor of the plant technical-service section. **W. H. Goff,** chemist, will succeed Pitts in quality control.

Michael Gigliotti, manager of product engineering for Monsanto Chemical Co.'s plastics division in Springfield, Mass., has been appointed assistant director of engineering for the division in Springfield. **C. Howard Adams,** senior engineering supervisor in the plastics division, Springfield, will succeed Gigliotti.

▶▶▶ Deaths

Thomas Thaddeus (Thad) Eason, 84, chairman and founder of Eason Oil Co., Oklahoma City, died September 27 in an Oklahoma City hospital. He had been in poor health for several years. Eason served as president of his independent company until 1955, when he became chairman. The company began as a marketing concern but diversified after merging with Healdton Oil & Gas Co. in 1929. Present name and form were assumed in 1952. Until 1958, when an explosion wrecked Eason's refinery, the firm was fully integrated.

Edward F. Ewing, 86, retired Kansas and Oklahoma independent operator, died September 27 in Arkansas City, Kans. Ewing was with the old Marland Oil Corp. in Ponca City, Okla., at one time.

Jerry H. Powell, 70, retired assistant counsel for Union Oil Co., died September 18 in a Los Angeles hospital.

Dell L. Schoenfeld, 69, retired president of Schoenfeld-Hunter-Kitch Drilling Co., Tulsa, died September 24 at the Mayo Clinic, Rochester, Minn. Schoenfeld was one of the founders of Schoenfeld-Hunter-Kitch and was a pioneer in discovery and development of Oklahoma's Oklahoma City and Seminole fields.

J. Lynne Knapp, 54, Owensboro, Ky., independent operator, died September 20 at his home in Owensboro.

A. D. Kneale, 71, retired assistant secretary and treasurer of the old Mid-Continent Petroleum Corp., died September 25 in a Mountain Home, Ark., hospital of cancer.

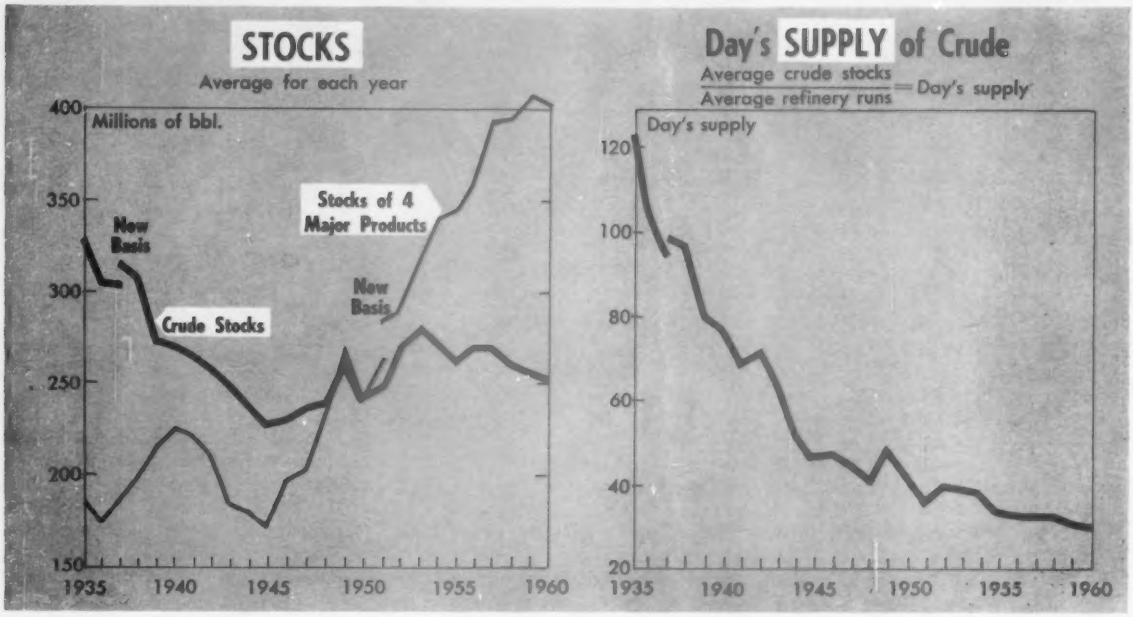
Walter J. Philp, 68, retired controller of Sunray Mid-Continent Oil Co., died September 27 in a Tulsa hospital of a heart ailment. Philp retired in 1957 after 31 years with Sunray and predecessor companies.

Albert L. Latta, 53, district production geologist for Gulf Oil Corp. in Oklahoma City, died September 21 in an Oklahoma City hospital after a heart attack. Latta had been with Gulf since 1925.

Arthur H. Oeth, Henderson, Ky., producer and drilling contractor, died September 17.

Neal Elder, 67, co-owner of Harbor Petroleum Co., Long Beach, Calif., died September 18 at his home in Los Angeles.

John Kincaid, 75, retired engineer with Independent Oil Producers in Broken Arrow, Okla., died September 18 in a Tulsa hospital.



STARTING with 1945, refiners increased major product stocks every year except 1950.

Stocks are high, but prices will hold

BY JOHN C. CASPER

CRUDE STOCKS are about 21,000,000 bbl. too low and major-product stocks 55,000,000 bbl. too high, based on current reports and a 24-company estimate of desirable stock levels.

Here are the details. According to reports from 24 companies to the Texas Railroad Commission, 253,400,000 bbl. is the desirable stock level for crude on October 31. Historically, stocks have been a little lower at the middle of September than at the end of October. This pattern would establish 251,000,000 bbl. as the desirable level for mid-September.

Bureau of Mines reported 229,994,000 bbl. in storage on September 17 or about 21,000,000 bbl. short of the desired level.

The same 24 companies set 393,700,000 bbl. as a good working level for major product stocks at the end of October. Since the major-product stock level at the middle of September is about 3.5% below the October 31 peak, the desirable level for mid-September would be near 379,500,000 bbl. API reported 434,500,000 bbl. for September 17 or about 55,000,000 bbl. too high.

There are three factors influencing stock levels this fall. Two of these are related to long-term trends but the third is from this year's oil-industry news.

Take a look at the first of the charts. It shows that the average annual level of crude inventories declined until the end of World War 2. There have been some increases since that time but there is no indication of a return to the high levels of the thirties.

On the other hand, major-product inventories have more than doubled since the mid-thirties. Month-end totals averaged more than 400,000,000 bbl. last year and will be almost as high this year.

The second chart shows that refiners have limited the growth of crude stocks despite sharp gains in refinery runs. Points on the line represent day's suply of crude, based on average stocks and refinery runs. The line shows a definite downward trend.

The third factor is related to the fuel supply for this winter. There have been rumors of a possible strike by refinery workers this fall. Such a rumor tends to boost runs if refiners can find the crude. The rumor also will tend to restrict early-season dump sales of distillate even though stocks of light fuels may be high.

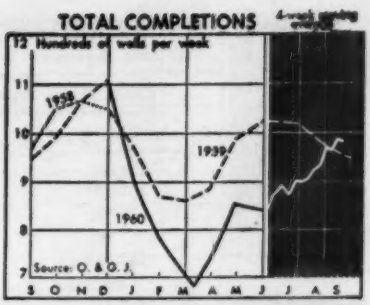
A quick look at the highlights . . .

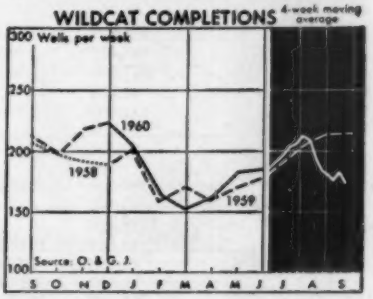
	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,891,920	UP	29,580	UP	38,490
Crude stocks	229,943,000	UP	2,156,000	DOWN	20,245,000
Completions	962	UP	5	UP	17
Refinery runs	7,963,000	DOWN	120,000	UP	241,000
Gasoline stocks	186,906,000	DOWN	2,542,000	UP	6,010,000
Kerosine stocks	34,896,000	UP	192,000	UP	2,679,000
Distillate stocks	165,447,000	UP	2,674,000	DOWN	6,954,000
Residual stocks	48,344,000	UP	711,000	DOWN	11,054,000
Four-product stocks	435,593,000	UP	1,035,000	DOWN	9,319,000
Total imports	1,558,700	DOWN	52,800	DOWN	94,400

Active Rotary Rigs

	9-26-60	9-19-60	9-28-59
Alabama	3	3	8
Alaska	7	7	(†)
Arkansas	11	13	15
Arizona	1	1	2
California	87	81	86
Land	84	78	83
Offshore	3	3	3
Colorado	52	51	52
Florida	2	1	2
Land	1	0	2
Offshore	1	1	0
Georgia	1	0	0
Illinois	40	50	45
Indiana	8	7	8
Iowa	1	0	1
Kansas	122	120	139
Kentucky	4	5	8
Louisiana	289	284	326
North	37	36	29
S. Inland waters	117	112	121
S. Land	76	82	120
Offshore	59	54	56
Maryland	0	0	0
Michigan	37	36	35
Mississippi	66	51	87
Missouri	1	2	0
Montana	25	25	26
Nebraska	23	21	25
Nevada	2	2	1
New Mexico	104	105	115
New York	2	2	0
North Dakota	16	14	24
Ohio	6	6	5
Oklahoma	155	170	220
Oregon	1	1	0
Pennsylvania	8	8	8
South Dakota	1	1	7
Texas	600	616	764
S. Inland waters	5	3	5
S. Land	156	174	193
Offshore	1	1	0
North	43	43	176
Panhandle	50	49	(*)
East	66	56	(*)
West Central	166	174	244
West	113	116	146
Utah	28	29	29
Washington	1	1	2
West Virginia	6	6	5
Wyoming	72	69	94
Total U. S.	1,782	1,788	2,139
Western Canada	143	135	181
Eastern Canada	0	0	1
Grand total	1,925	1,923	2,321

Hughes Tool Co. report. *Included in North. Comparisons not available due to change in method of reporting. †Data first reported 4-4-60.





WEEKLY WELL COMPLETIONS . . . WEEK ENDED SEPTEMBER 24, 1960

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1960	1959	Total	Crude	Cond.	Gas	Dry	1960	1959
Alabama	0	0	0	0	0	0	0	33	75	0	0	0	0	0	2	20
Arizona	0	0	0	0	0	0	0	28	.....	0	0	0	0	0	18	.....
Arkansas	11	4	0	1	5	1	31,197	436	606	2	0	0	0	2	116	107
California	31	22	0	4	5	0	139,099	1,184	1,112	4	0	0	0	4	224	287
Colorado	12	2	0	2	8	0	67,477	465	564	7	1	0	0	6	234	336
Illinois	55	15	0	0	26	14	113,560	1,646	1,663	18	1	0	0	17	343	284
Indiana	17	5	0	0	12	0	26,463	762	621	6	0	0	0	6	278	212
Kansas	121	68	0	4	36	13	234,794	2,712	2,950	20	3	0	2	15	760	738
Kentucky	82	2	0	15	15	50	139,580	1,531	1,768	2	0	0	0	2	127	193
Louisiana	81	34	11	7	29	0	613,400	2,592	2,719	5	0	1	0	4	397	367
North	34	14	0	5	15	0	106,171	973	1,045	2	0	0	0	2	191	162
South	37	17	8	2	10	0	401,930	1,253	1,377	3	0	1	0	2	181	191
Offshore	10	3	3	0	4	0	105,299	366	297	0	0	0	0	0	25	14
Michigan	15	5	0	0	9	1	53,658	672	472	6	0	0	0	6	175	120
Mississippi	7	1	0	0	6	0	74,828	504	470	3	0	0	0	3	194	208
Montana	12	6	0	0	6	0	51,657	233	237	4	0	0	0	4	109	75
Nebraska	10	4	0	0	6	0	54,706	637	672	6	1	0	0	5	260	288
New Mexico	35	22	0	4	9	0	175,067	1,351	1,516	5	0	0	0	5	203	176
West	14	5	0	4	5	0	54,546	460	681	4	0	0	0	4	54	47
East	21	17	0	0	4	0	120,521	891	835	1	0	0	0	1	149	129
New York	0	0	0	0	0	0	0	232	195	0	0	0	0	0	33	18
North Dakota	6	4	0	0	2	0	49,730	219	351	2	0	0	0	2	59	67
Ohio	31	12	0	11	6	2	97,657	785	736	2	0	0	0	2	38	23
Oklahoma	71	30	0	2	27	12	249,650	3,410	4,187	9	0	0	1	8	549	639
Pennsylvania	79	24	0	29	9	17	273,663	519	392	2	0	0	2	0	10	10
South Dakota	0	0	0	0	0	0	0	18	.....	0	0	0	0	0	7	.....
Texas	245	124	12	29	76	4	1,038,630	11,457	13,914	36	5	1	0	30	2,348	2,622
Dist. 1	13	2	0	2	9	0	49,929	788	780	5	0	0	0	5	296	226
Dist. 2	16	5	3	5	3	0	101,626	569	583	2	0	0	0	2	142	173
Dist. 3	20	8	0	2	10	0	142,297	872	887	4	1	0	0	3	163	180
Dist. 4	12	4	0	4	3	1	65,929	790	992	0	0	0	0	0	222	247
East	34	21	6	0	6	1	155,566	933	906	2	0	1	0	1	188	175
Dist. 7-B	32	15	0	0	17	0	90,616	1,673	1,917	8	1	0	0	7	480	508
West	52	38	0	3	9	2	254,284	2,997	4,269	7	2	0	0	5	462	590
Dist. 9	41	24	1	0	16	0	97,156	2,083	2,617	7	1	0	0	6	351	444
Dist. 10	25	7	2	13	3	0	81,227	752	963	1	0	0	0	1	44	79
Utah	0	0	0	0	0	0	0	173	233	0	0	0	0	0	59	62
West Virginia	23	4	0	18	1	0	54,331	602	577	0	0	0	0	0	6	24
Wyoming	10	4	0	0	6	0	45,985	756	727	5	0	0	0	5	309	250
Misc. (Tenn.)	8	0	0	1	7	0	6,941	113	103	8	0	0	1	7	103	68
Total U. S.	962	392	23	127	306	114	3,592,073	33,070	36,860	152	11	2	6	133	6,961	7,194
Previous week	959	410	27	65	342	115	3,453,679	.....	.....	183	18	2	9	154	.....	.....
Cum. 1960	33,070	14,980	969	2,743	12,558	1,820	138,652,503	.....	.....	6,961	613	78	235	6,035	.....	.....
Cum. 1959	36,860	18,410	901	2,696	13,872	981	153,529,699	.....	.....	7,194	668	90	229	6,207	.....	.....
Western Canada	44	29	0	5	10	0	261,062	1,699	1,791	8	1	0	1	6	444	504

PRODUCTION

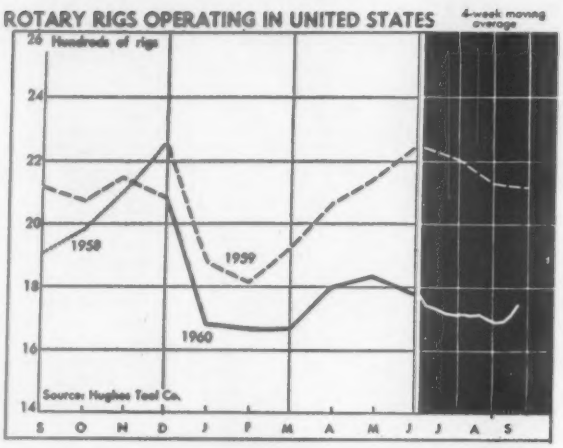
DAILY AVERAGE PRODUCTION FOR WEEK

	September 24, 1960			Sept. 17
	Crude oil	Lease condensate	Total	total
Alabama	22,000	.....	22,000	21,500
Arkansas	77,200	200	77,400	77,325
California	828,800	.....	828,800	829,000
Colorado	131,700	.....	131,700	132,300
Eastern	39,800	.....	39,800	40,700
Florida	900	.....	900	900
Illinois	217,400	.....	217,400	218,500
Indiana	31,000	.....	31,000	32,100
Kansas	†304,895	.....	†304,895	†294,515
Kentucky	56,700	.....	56,700	60,100
Louisiana	951,325	123,450	1,074,775	1,075,950
North	104,325	5,950	110,275	111,450
South	847,000	117,500	964,500	964,500
Michigan	41,800	.....	41,800	41,900
Mississippi	132,000	3,550	135,550	135,550
Montana	82,000	.....	82,000	82,500
Nebraska	67,200	.....	67,200	65,500
Nevada	100	.....	100	100
New Mexico	287,500	8,000	295,500	295,500
North Dakota	62,300	.....	62,300	64,700
Oklahoma	†499,700	.....	†499,700	†475,500
Texas	2,380,000	81,500	2,461,500	2,461,500
Dist. 1	42,000	2,500	44,500	44,500
Dist. 2	98,000	8,000	106,000	106,000
Dist. 3	306,000	36,000	342,000	342,000
Dist. 4	171,000	12,200	183,200	183,200
Dist. 5	26,000	300	26,300	26,300
Dist. 6	109,000	9,800	118,800	118,800
East Texas field	124,000	.....	124,000	124,000
Dist. 7-B	129,000	125	129,125	129,125
Dist. 7-C	113,000	3,050	116,050	116,050
Dist. 8	960,000	7,000	967,000	967,000
Dist. 9	195,000	1,600	196,600	196,600
Dist. 10	107,000	925	107,925	107,925
Utah	102,200	.....	102,200	96,900
Wyoming	357,100	.....	357,100	358,200
Others	‡1,600	.....	‡1,600	‡1,600
Total U. S.	6,675,220	216,700	6,891,920	6,862,340
Change from previous week, up			29,580	
Canada	546,700	.....	546,700	†539,500

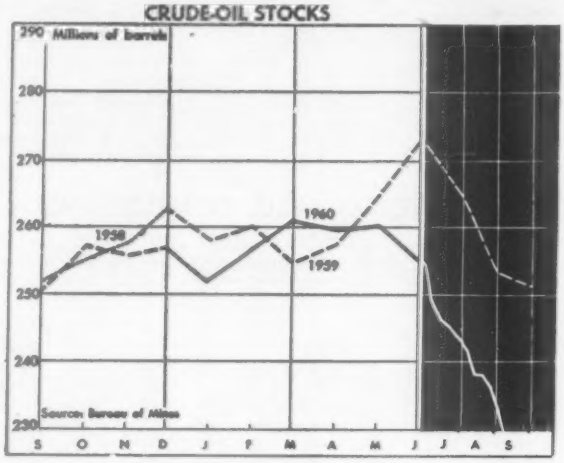
Total U. S. production—Jan. 1-Sept. 24 ..... 1,875,915,900 bbl.
Same period last year (crude plus cond.) ..... *1,886,769,100 bbl.

*Includes 49,827,700 bbl. condensate. †Week ended previous Monday. ‡Alaska, South Dakota, and Arizona.

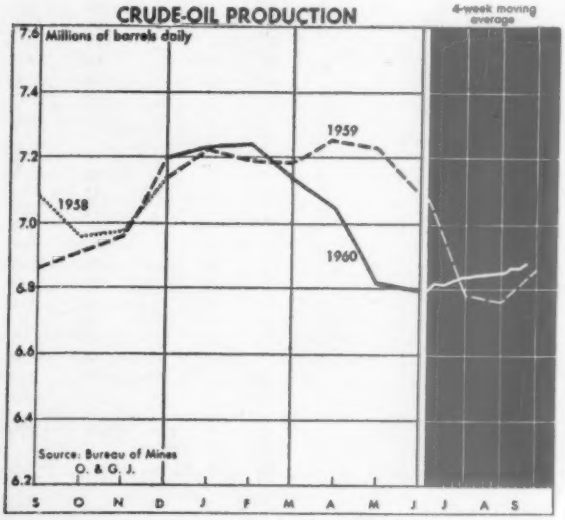
ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL PRODUCTION

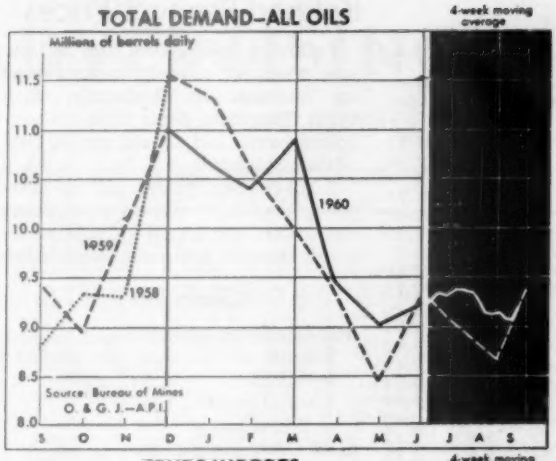


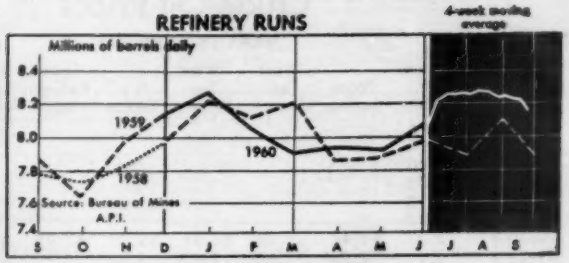
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

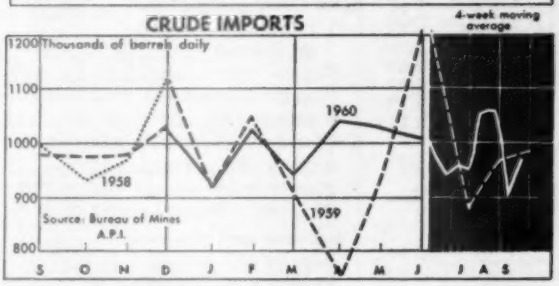
(Thousands of barrels)

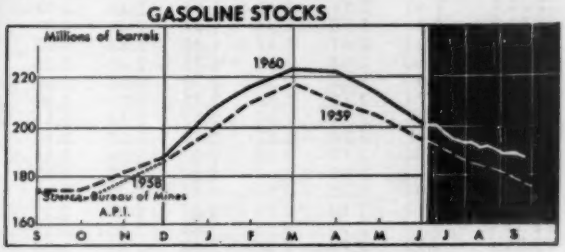
	9-17-60	9-10-60	9-19-59
Pennsylvania	2,327	2,312	2,659
Other Appalachian	1,569	1,473	2,091
Illinois, Indiana, Michigan	9,160	9,029	9,643
Nebraska and North Dakota	2,795	2,813	2,865
Kansas	8,518	8,658	10,206
Oklahoma	14,916	14,793	13,967
Arkansas	1,837	1,900	2,147
Louisiana	17,386	18,056	18,552
North	3,069	2,975	3,518
South	14,317	15,081	15,034
Mississippi, Alabama, Florida	1,659	1,896	2,576
New Mexico	8,337	7,927	7,687
Texas	96,604	96,918	107,468
East Texas	7,661	7,727	8,963
West Texas	47,169	46,690	49,943
Texas Gulf	16,305	16,101	18,437
Other Texas	25,469	26,400	30,125
Wyoming	15,120	14,403	15,990
Other Rocky Mountain	9,285	9,345	9,298
California	25,962	26,095	29,749
Foreign	†14,468	12,169	15,290
Total	229,943	227,787	250,188

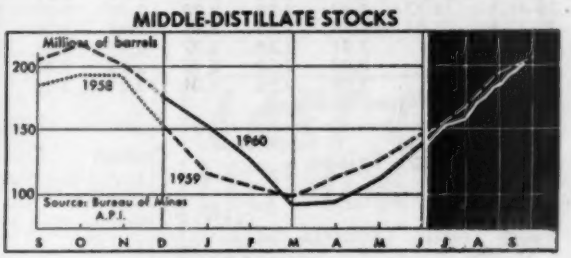
*Bureau of Mines. †Includes 4,688,000 bbl. in California.

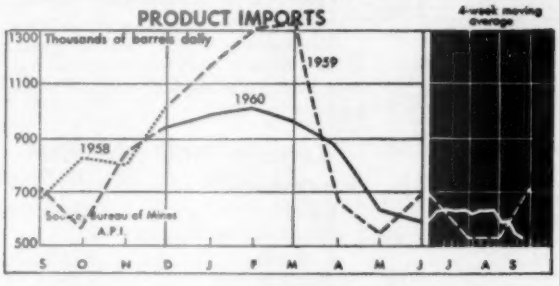


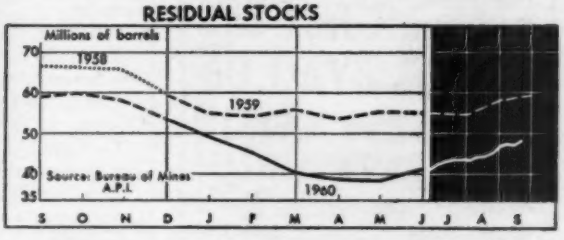












API REFINERY REPORT—SEPTEMBER 23, 1960

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, September, 1959 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,199	493.4	29.4	365.3	122.2	43,452	13,632	16,995	12,396	1,065	520.0	30.8	321.1	151.0
Appalachian:														
District 1	84	39.4	4.1	19.8	4.6	5,905	778	4,086	496	97	41.8	2.6	21.4	6.2
District 2	107	59.4	7.4	19.6	11.0	3,000	493	1,714	323	96	52.9	5.6	16.8	6.2
Ind., Ill., Ky.	1,465	793.2	62.0	331.3	144.8	31,936	7,333	29,818	5,950	1,441	775.5	61.5	298.0	135.9
Minn., Wis., Dak.	115	52.4	2.4	34.6	15.7	6,242	1,518	8,187	609	104	49.6	4.6	27.0	11.0
Okla., Kans., Mo.	706	411.1	9.6	167.3	23.0	17,216	1,876	13,999	929	737	412.0	8.8	189.4	22.1
Inland Texas	284	225.4	9.0	42.4	20.4	6,662	668	1,529	2,544	276	217.7	7.1	47.9	21.0
Texas Gulf Coast	1,759	972.5	101.2	434.0	130.4	24,600	3,737	17,499	5,813	1,795	911.7	86.9	420.1	138.8
La. Gulf Coast	662	355.9	42.4	144.3	42.6	10,792	1,740	6,923	1,443	706	377.7	61.1	147.8	49.2
N. La. and Ark.	112	59.4	5.6	26.1	3.9	5,113	1,299	1,931	137	73	33.5	3.1	13.9	5.4
Rocky Mountain:														
New Mexico	26	5.3	0.3	4.9	3.3	578	46	173	7	23	12.1	0.2	4.4	2.1
Other R'ky Mt.	283	129.1	3.0	61.8	33.3	4,892	385	3,034	1,068	305	145.9	3.3	61.7	32.2
West Coast	1,161	485.6	36.3	152.0	357.4	26,518	1,391	14,559	16,629	1,160	521.8	1.2	175.7	271.5
Sept. 23, 1960	7,963	4,082.1	312.7	1,803.4	912.6	186,906	34,896	165,447	48,344	7,878	4,072.2	276.8	1,745.2	852.7
Sept. 16, 1960	8,083	4,195.0	366.7	1,883.0	815.9	189,448	34,704	162,773	47,633	.....	.....	.....	.....	.....
Sept. 25, 1959	7,722	4,011.1	279.1	1,736.5	904.7	180,896	32,217	172,401	59,398	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil Prices

GRAVITY SCHEDULE

	★ Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Julesburg	Wyo. (sour)
14-14.9	$1.86	....	....	....	....	....	....	....	....
15-15.9	1.93	....	....	....	....	....	....	....	$1.81
16-16.9	2.00	....	....	....	....	....	....	....	1.86
17-17.9	2.06	....	....	....	....	....	....	....	1.91
18-18.9	2.13	....	....	....	....	....	....	....	1.96
19-19.9	2.20	....	....	....	....	....	....	....	2.01
20-20.9	2.27	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.33	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.40	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague.

Flat Prices

Louisiana:
- Sweet Lake $3.00

Texas:
- East Texas 3.05-3.25
- Conroe 3.23-3.53
- Van 3.08

Pennsylvania Grade:
- Bradford $4.75-4.80
- Middle District 4.52
- Southwest Pennsylvania 4.25
- West Virginia 4.17
- Buckeye Grade 4.08

Illinois Basin 3.00-3.05

Foreign

Middle East, Persian Gulf: (cargoes f.o.b. lifting port)
- Arabian, 34.0°-34.9°, Ras Tanura $1.80
- Iranian, 34.0°-34.9°, Bandar Mashur 1.78
- Iranian, 34.0°-34.9°, Abadan 1.73
- Iraq, 35.0°-35.9°, Fao 1.72
- Kuwait, 31.0°-31.9°, Mina-al-Ahmadi 1.59
- Qata, 41.0°-41.9°, Umm Said 1.95

Middle East, E. Mediterranean:
- Arabian, 34.0°-34.9°, Sidon $2.17
- Iraq, Mosul-Kirkuk, 35.0°-35.9°, Tripoli 2.19

Far East (cargoes, f.o.b. Lutong, Sarawak):
- Seria Light, 36° 2.42

Canada:
- Leduc-Woodbend $2.53
- Redwater (Alta.) 2.42
- Smiley (Sask.) 2.18
- Pembina 2.38

Venezuela:
- Cumbarebo, 47°-47.9°, Tucupido 3.34
- San Joaquin, 40°-40.9°, Puerto La Cruz 3.08
- Oficina, 35°-35.9°, Puerto La Cruz 2.80
- Tia Juana medium, 26°-26.9°, Amuay* 2.30
- Quiriquire, 16.0°-16.4°, Caripito 2.10
- Lagunillas heavy, flat, Las Piedras* 2.10
- Bachaquero, flat, 15°-16°, Las Piedras* 1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Tanker Rates (Long Ton)

(Latest reported spot fixtures)
- Gulf-NY clean (ATRS −10%) $2.57
- ★ Carib.-UK, dirty (Scale −59%) (13s. 4d.) 1.87
- PG-UK, dirty (Scale −45%) (32s. 7d.) 4.56
- ★ PG-NY, dirty (USMC −60%) 5.08

★ Denotes change from previous week.

Refined-Product Prices

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

Gasoline*

Mid-Continent (Group 3):
- Regular (91 octane) .. $12.25-12.50
- Premium (99 octane) 15.00-15.25
- Natural gasoline (26-70) 4.5
- Breckenridge 4.0

Gulf Coast (cargoes for coastwise or export movements):
- Regular (90 octane) .. 11.00
- Regular (92 octane) .. 11.25
- Premium (98 octane) 12.25

California (rack) Los Angeles:
- Regular (88 octane) .. 11.65-12.15
- Premium (94 octane) 12.65-13.15
- Premium (100 octane) 14.00-14.65

Caribbean area (cargoes):
- Regular (87 octane) 10.125-10.25
- Premium (97 octane) 11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

Kerosine and Distillate

Mid-Continent (Group 3):
- Kerosine 42-44 ....10.125-10.375
- Diesel oil (58 d.i. and above) 9.75-10.00
- Distillate No. 1 ..... 9.75-10.00
- Distillate No. 2 ..... 8.75- 9.00

Gulf Coast (cargoes):
- Kerosine 41-43 ..... 9.00- 9.25
- Distillate No. 2 ..... 8.25

New York Harbor (barges):
- Kerosine 41-43 ..... 10.45
- Distillate No. 2 ..... 9.45
- Diesel fuel, 48-52 d.i. 9.65

Caribbean area (cargoes):
- Distillate No. 2 ..... 8.125

Residual Fuel (Bbl.)

Mid-Continent (Group 3):
- Residual fuel (max. 1% S) $1.90

Gulf Coast (cargoes):
- Bunker C fuel 2.30

New York Harbor (barges):
- Bunker C fuel 2.52

Caribbean (cargoes):
- Bunker C 2.10

California (rack):
- ★ Bunker C fuel, Los Angeles 2.25

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ENGINES—PUMPS

2—Cooper-Bessemer Type JS-5-G, 330 H.P. @ 350 r.p.m., 13" x 16", 5 Cyl., 4 Cycle, Vertical Natural Gas Engines, fully equipped.

3—National Transit 5¾" x 18" Hor. Dup. Power Pumps, G. R. 5.95:1, Cap. 15,000 B. D. @ 1,000 psi.

1—Steel Building 56' wide, 100'-6" long, 16'-3" high, Steel Frame, Corrugated Transite Walls and Roof, like new condition.

Above three items located Lake St. John, La.

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1—Ross Model #2308, 24" x 10' 6" Horizontal Heat Exchanger.

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All priced attractively for prompt sale and removal.

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228,000# Peak Torque—Single Reduction
6,000' 7" OD Casing, 24# Seamless R-2 10V thd.
5,280' 3" OD 7.57# Beveled Line Pipe
6 & 10 Ton YALE Triplex Spur-Geared Chain Hoists
300 sq. Ft. Steel U-Tube Reboiler
HEAT & POWER CO., INC.
310 Thompson Building, Tulsa 3, Okla.

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45—12" Gate Valves, CRANE, 300#, $100. ea.

All above in very clean and good condition.
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2,000,000 ft. 2"	3.50# to the ft.
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All No. 1 Grade Plain end and cleaned.
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ONE—COLEMAN Instrument Co. Controlled temperature bath for calibrating BHP instruments with Model "H" Coleman 10,000# Dead Weight Tester. Send bids to Gulf Oil Corp., attention T. R. Coffield, P. O. Box 648, Laurel, Miss.

THE FOLLOWING for sale to highest bidder on where is, as is basis: One 1957 R-194, International Oilfield Truck, fully equipped. One 1958 Model-555A, GMC Oilfield Truck, fully equipped. One 1952 Nabors 26-Ft. Tandem Laydown Float. One 1955 Nabors Tandem Pole Trailer. One 1952 Nabors 28-Ft. Tandem Laydown Float. One Re-built Tandem Pole Trailer w/Neway Unit. Descriptive list will be mailed with bidding instructions upon request. All bids must be mailed to Shell Oil Co., P. O. Box 1509, Midland Texas, and Postmarked not later than Oct. 24th.

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Steel Tube: 3280, 2100, 1200, 950 sq. ft.
Adm. Tube: 2800, 2700, 2600, 2100, 1700, 1500 1375, 1250, 1100, 1000, 920, 650 sq. ft.
20 Fin Tubes: 50-190 sq. ft.

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8' x 75' 20 Tray 25#	4' x 36' packed 210#
7½' x 56' 20 Tray 35#	10' x 55' 60#
3' x 58' 30 Tray 154#	8' x 43' 60#
3' x 47' 20 Tray 120#	6' x 42' 200#
18" x 32' 15 Tray 130#	6' x 20' 40#
2' x 30' packed 50#	12' x 43' 25#

PUMPS

Hot Oil: 1"-6"; 50-400 gpm 100-3,000 ft. hd.
Boiler Feed: 190 gpm 1,500' hd.
Cooling Tower: 7,000 gpm 120' hd.
River Water Sump: 1,000 gpm 59' hd.

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15 Storage Tanks welded: 29,000, 10,000, 5,000, 3,750 barrel.
5 Spheres-Spheroids: 5,000, 10,000 barrel.

1—Carrier 1,000 ton refrigeration Compressor Turbine drive. (1953)
2—IR Turbo Exhausters 15,300 & 17,000 CFM 4.85 PSIG with Turbine Drives.
1—Clark Centrifugal Compressor 10,000 CFM—240 PSI discharge. (1953)

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1 Lummus: 35 mil. BTU furnace
2 Petro-Chem. Furnace: 1¼ mil. & 8 mil. BTU
2 B&W Boilers: 70,000# per hr.-450#
1 IR-XVG-4 Compressor
1 Worth LT-6 Compressor

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FOR SALE: Skid mounted cable dump bodies suitable for use on standard oil field float trailers or bobtail trucks. Ten to twenty yd. capacity. Bode & Broughton, P. O. Box 313, Sinton, Texas.

MECO WATER DISTILLATION UNIT Unused Model 300K Unit complete, located at Alta Loma, Texas (near Houston)—Price $10,000.00 Overseas Drilling Company, 700 Mercantile Bank Building, Dallas, Texas—Phone: RI 1-3561.

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American 109,000# P.T. 54" stroke D.R.
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Can furnish cylinder needed and with new or rebuilt engine.
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This machine has all extras.
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THE OIL AND GAS JOURNAL
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PROCESS ENGINEER: Modern independent refinery desires chemical or mechanical engineer to calculate weight balances, economics, etc. Must have some operating experience. Location in central Mid-Continent area. Box M-113, The Oil and Gas Journal, Tulsa, Oklahoma.

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The Oil and Gas Journal
Tulsa, Oklahoma

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CLIENT DESIRES to participate in drilling prospects to maximum ¼ interest. Must stand rigid inspection. Reply in detail to G. R. Stocker, geologist, 797 Lynwood Street, Raritan, New Jersey.

CAPITAL WANTED

CAPITAL NEEDED to drill offset production in West Virginia and Ohio. If you have the dough, I have the know. David Law—Phone HU 5-6446, 716 Union Trust Building, Parkersburg, West Virginia.

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WANTED: GEOLOGICAL file on North Central Oklahoma. E-logs, sample logs, scout tickets. Contact: McClung, c/o W. H. Pine, Okmulgee, Oklahoma.

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FOR SALE: Oil and Gas Journals from year 1955 to 1960. Good shape. Box M-119, The Oil and Gas Journal, Tulsa, Okla.

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LEASE AND DRILLING BLOCKS

⅛ WORKING INTEREST. Thurlow Field, Green County, Kentucky. 4 wells 1 year old. 55 acres room for 6 more. New drilling on adjoining leases. Present income $154.29 per month. Price $12,000. Reply, Box L-987, The Oil and Gas Journal, Tulsa, Oklahoma.

MICHIGAN, SCIPIO Township, Section 12-5S-3W 80 acres. Section 23-5S-3W 120 acres. (Near Gusher.) Indiana, Spencer County, Section 8-6S-5W 160 acres. Elkhart County 1,500 acres (former shallow production). Illinois, Wayne County, Section 2-1S-7E 400 acres. A. P. 2017 West 47th Street, Chicago, Illinois. FRontier 6-2550.

RELIABLE OIL COMPANY would like to make deal to develop shallow locations in Southwest. Have equipment for 15 or more wells. Can finance all or part with reasonable pay-out. Box M-120, The Oil and Gas Journal, Tulsa, Oklahoma.

EASTERN KANSAS 155 acres four proven locations Bartlesville Sand Production 1,200 ft. deep. Offsetting large flood. 8/16ths for sale $400.00 per 1/16th to drill No. 1. Box M-118, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: ½ interest 4 Berea Sand wells Penn grade oil $4.08 bbl. good equipment 1,200 ft. deep 40-A. lease 3 inside location to drill price $25,000. Income $500.00 per month can be stepped up to $2,000, or more. Reply P. O. Box 81, or phone 4-8367, Cambridge, Ohio.

HAVE 5,000 A. State and Federal Leases, S. Arizona. Well 1,900 feet near bottom of Penn penetrated 38 feet 4% to 8% porosity lime with gas and oil shows. Desirous exploring Miss and Devonian another 1,200 feet. Funds exhausted. Give wonderful deal for completion. FRASER, CR 4-5659, Phoenix.

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BENT COUNTY, Colorado. Good structure near pipeline. 2,500 acres checkerboard for 5,800 ft. test. H. C. Petersen, 1017 Sidney Street, Ohaha 47, Nebr.

NEED SHALLOW farmouts and drilling deals in North and West Central Texas. All propositions considered. Box 12245, Milco Supply Company, Fort Worth, Texas.

EAST COALINGA OIL FIELD in California, 15 lots for sale, including mineral rights. $200 each. M. G. Beall, 9412 Yolanda, Northridge, Calif. DI 9-3223.

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LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Sacramento, California. Notice is hereby given that 570 acres of land in ten parcels within the known geologic structures of certain fields in Kern County, California, will be offered for competitive oil and gas leasing through sealed bids to the qualified bidder of the highest cash amount per acre at 10:30 A. M., PST, October 20, 1960, when bids will be opened. Full details of the lease offering, how and where to submit bids, may be obtained from the Manager of the Land Office at Sacramento, California. Walter E. Beck, Manager.

(Continued from page 159)

New Mexico's Lea County gets good Abo reef hit

A wildcat in southwestern Lea County, Southeast New Mexico, flowed oil on a drill-stem test in the Abo reef. It is Standard Oil Co. of Texas' 2 Vacuum Edge unit, 20 miles northwest of Hobbs in 4-18s-35e.

Operator is coring ahead below 8,378 ft. toward slated 9,100-ft target after finding oil in the Abo on drill-stem test at 8,273-8,341 ft. The well flowed at the estimated hourly rate of 35 bbl. during the test. It is on the south side of Vacuum field.

Texas adds new big gas producer

A gas well rated good for 100 M.M.c.f.d. has been completed in the relatively shallow lower Vicksburg sands of Conroe field, in Montgomery County, Texas Gulf Coast.

Main production, both oil and gas, at Conroe has been from Cockfield and Yegua sands at depths below 5,000 ft.

The new Vicksburg gas well is Humble Oil & Refining Co's. 44 Madeley, 5½ miles southeast of Conroe in the Ransom House Survey. Its pay is perforated at 3,794-3,806 ft. Shut-in pressure of the well is 1,675 psi.

While testing, using adjustable chokes, the well flowed at rates up to 2,690 M.c.f.d. at pressures of 1,557 to 1,580 psi.

Gas-condensate find for Texas Gulf area

A rich gas-condensate discovery has been made 8½ miles southeast of Mount Belvieu in northwestern Chambers County, Texas Gulf Coast.

Discovery well, 1 Julia H. Casey Estate, is a joint operation of J. M. Huber Corp. and the estate of J. P. Petkas. It is nearly a mile northeast of the relatively new Petkas field, and just inshore from Trinity Bay.

Open-flow potential of the well is placed at 10 M.M.c.f.d. with condensate recovery of 10 bbl. per M.M. c.f. Condensate-gravity is 49.2°. Shut-in pressure is 2,250 psi.

Utah's Lisbon leads Rockies' exploration

Utah's Lisbon area is once again the No. 1 exploratory arena in the Rockies. Pubco Petroleum Co. reportedly got 45 bbl. of 54°-gravity oil in 1 hour on drill-stem test of Mississip-

pian at the 1 Lisbon-Federal in 12-30s-24e, San Juan County.

The well also had 6,078 M.c.f.d. on drill-stem test. This well is 2¼ miles southeast of the field discovery well.

Southeast Lisbon. Belco Petroleum Co. will drill a 9,500-ft. Mississippian test on the southeast end of the Lisbon anticline in San Miguel County, Colorado.

The 1 Egnar unit, 30-44n-19w (2 miles southwest of the Pure Oil Co. 3 Southeast Lisbon-U.S.A. in 16-44n-19w, is shut in after flowing gas and condensate from Mississippian), is the first work on this southeast end of the anticline except for Pure's four locations in the area.

Discovery Wells

KANSAS

Barber County:

Crescent Oil & Gas Co. 2 Elsea, C NW NE 25-32s-14w. IP 312 BOPD, Viola 4,870-73 ft. TD 5,065 ft. New pay at West Palmer field.

Barton County:

Bennett & Roberts Oil Operations 1 Frees, SW SE NE 23-16s-11w. IP 26 BOPD, 40% b.s. and w., 41.6°, Arbuckle 3,372-81 ft. TD 3,381 ft. Opens Frees field.

Comanche County:

J. M. Huber Corp. and Pure Oil Co. 1 Keller, C NW SE 22-32s-18w. IP 288 BOPD, 6% b.s. and w., 8,430 M.c.f.d., 42°, Mississippian 5,116-72 ft., Viola 5,652-90 ft. TD 5,960 ft. Opens Wescautunga field.

Edwards County:

National Drilling Co. and Northern Natural BOA 1 Fatzer, C SW SW 34-25s-17w. IPF 4,740 M.c.f.d., conglomerate 4,490-4,504 ft. TD 4,632 ft. Opens Felisburg field.

Ellis County:

Murfin Drilling Co. et al. 1 Burnham unit, SE NW SE 11-14s-18w. IP 21 BOPD, 90 BWPD, Arbuckle, 3,560-86 ft. TD 3,692 ft. Opens Burnham field.

Birmingham-Bartlett Drilling Co. 1 Flaz, NW NW SW 20-13s-20w. IP 166 BOPD, Arbuckle 3,888-92 ft. TD 3,892 ft. New field.

Haskell County:

United Producing Co. 1 J. J. Walton, C NW NE 4-30s-34w. IP 528 BOPD, Morrow 5,250-68 ft.; Chester 5,408-18 ft. TD 5,950 ft. New field.

Marion County:

D. E. Kays 1 Meise, C SE SW 32-18s-5e. IP 3,167 M.c.f.d., Miss. 2,287-2,352 ft. TD 2,352 ft.

Rooks County:

Cities Service Oil Co. 1 Simons "B," NE SW SW 11-7s-17w. IP 71 BOPD, 29 BWPD, 41°, Lansing-Kansas City 2,915-3,021 ft. TD 3,319 ft. Opens Simons field.

EAST TEXAS

Freestone County:

Thomas W. Clay, J. Burns Brown, and G. C. Clark 1 Jewell L. Crow et al., J. P. Plummer Sur., A-755, 4½ miles southwest of Teague. IP 500 M.c.f.d., calculated open flow, and 3 BC per M.M.c.f., shut-in TP 2,400 psi., perf. 7,032-38 ft., Rodessa. TD 7,935 ft. New-field discovery.

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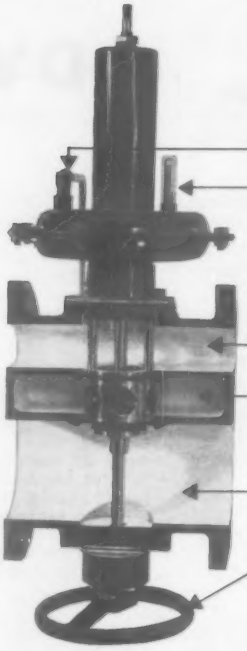
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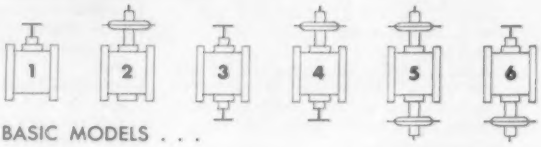

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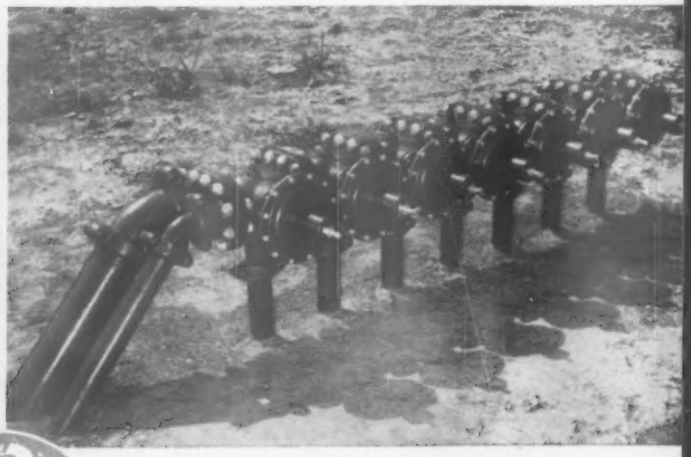

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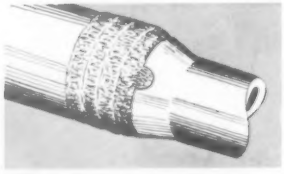

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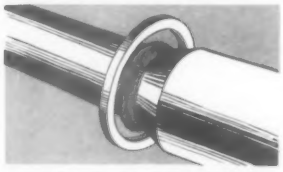

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